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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XVII

WITH 39 PLATES

1929

ST. LOUIS, MISSOURI

PUBLISHED MONTHLY EXCEPT JULY AND AUGUST,
BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:
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Missouri Botanical Garden Bulletin

Vol. XVII JANUARY, 1929 No. 1

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OF THE MISSOURI BOTANICAL GARDEN

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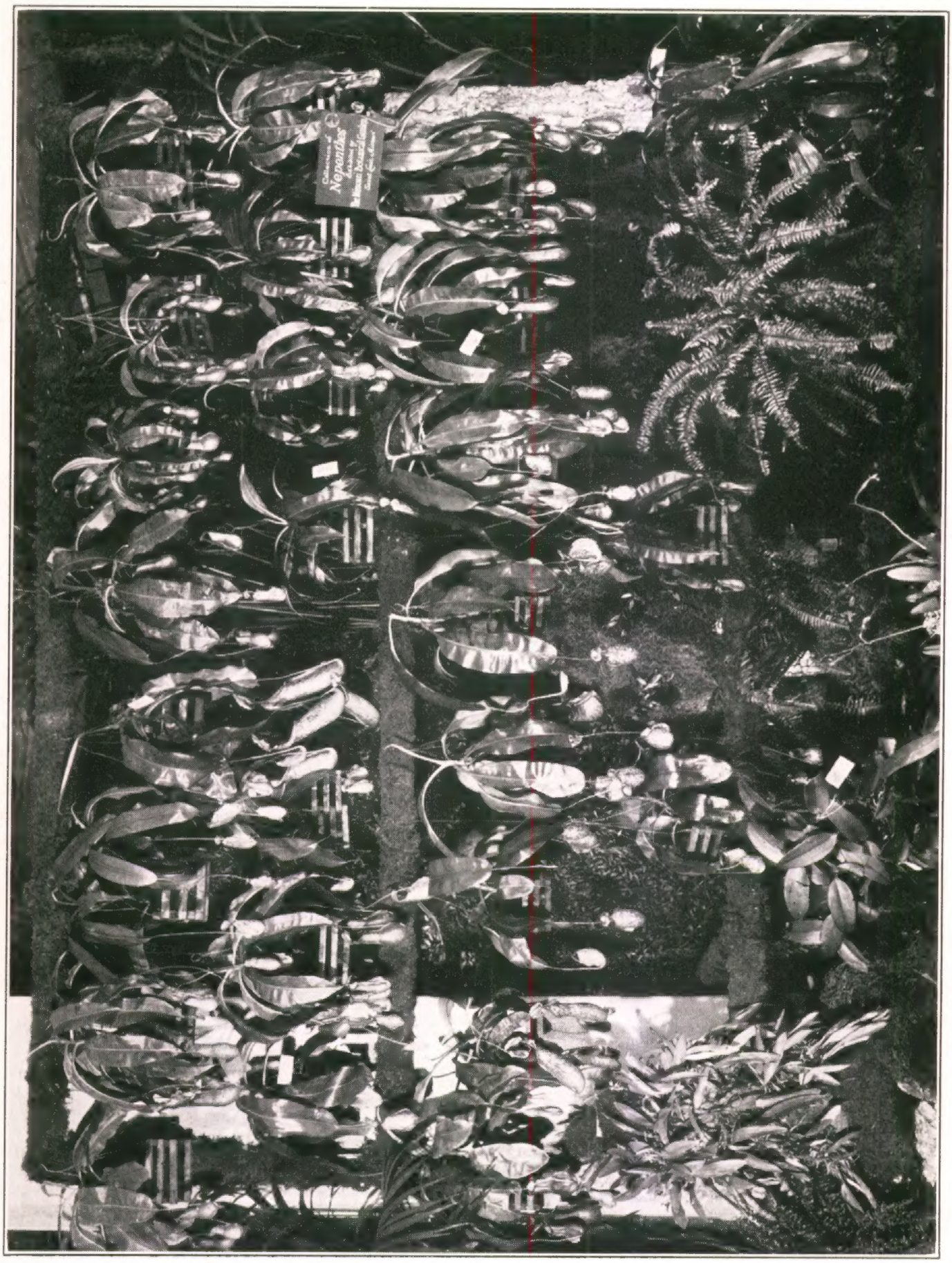

GARDEN'S EXHIBIT OF NEPENTHES AT THE NATIONAL ORCHID SHOW, NEW YORK.

Missouri Botanical Garden Bulletin

Vol. XVII JANUARY, 1929 No. 1

FORTIETH ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the fortieth annual report of the Director.

In ancient times it was customary for men to name each year worthy of remembrance for the outstanding event which characterized it. Similarly, the annual reports for the past few years have discussed noteworthy achievements or happenings at the Garden which have made such an impression that one in looking back might well speak of "the year of the acquisition of the Gray Summit Extension", "the year of the hailstorm", "the year of the cyclone", "the year of building the conservatories", etc.

While the year 1928 has been one of distinct progress in several important features of the Garden, perhaps the one thing for which it will be longest remembered is the great increase in attendance. For the first time in its history the number of visitors passed the 400,000 mark, even exceeding by more than 100,000 that of the World's Fair year. That the interest of the public in the Garden was gradually increasing has been manifested from year to year, but the sudden addition of 150,000 in attendance during 1928 was wholly unexpected. Not only was the total number of visitors for the year much greater, but the largest previous daily attendance was surpassed, as was the total number for each month.

Attendance at an institution like the Garden is based primarily upon three things, namely, something worth while to see, publicity, and the weather. In regard to the first item it has been possible to pay more attention during the past year to special features in connection with the floral displays and this has evidently been appreciated. In regard to publicity it is fair to say that no other public garden in any city

receives the intelligent attention given by the press that the Missouri Botanical Garden does. Frequent news items with numerous pictures of floral displays or plants of special interest, with occasional feature stories of considerable length, all combine to remind the public of the Garden. It is interesting to note that immediately after the newspapers have mentioned the Garden the fact is reflected in the attendance. While visitors come to the Garden daily irrespective of the weather, a bad Sunday afternoon may cut the attendance in half and a succession of bad days at the time of an important floral display may seriously reduce the attendance for the year. Undoubtedly one factor in the sudden increase in visitors during 1928 was the favorable weather at what might be termed critical periods.

It is extremely difficult to analyze all of the factors influencing attendance. Whether the automobile, for instance, is favorable to an increase in the number of visitors is a question. Of course, it is now easier for many people to get to the Garden, but it is also easier for them to get to the country in fine weather, and it is certainly a fact that St. Louis now affords many more additional opportunities for recreation and amusement than in earlier days when the Garden was one of the few public attractions in the city. Naturally with an increasing population a gradual increase in visitors should be expected, but this one fact, of course, is not sufficient to account for the sudden jump in 1928. Because of the varying character of other botanical gardens, many of which are visited as public parks even more than for the display of flowers and interesting plants, it is extremely difficult to make comparisons. However, it can safely be said that the number of visitors to the Missouri Botanical Garden last year was greater in proportion to the population of the city and surrounding territory than that of any other botanical garden in the world.

While the number of visitors is a gratifying evidence of the interest now taken in the Garden, it is likewise a matter of some concern since increased attendance means an increase in cost. Were an admission fee charged, as is the case at many gardens, a large attendance would bring with it an increase in revenue, but this does not apply to the Missouri Botanical Garden. Furthermore, large crowds place definite limitations upon the arrangement of regular and special floral displays. Obviously it would be possible to stage plants much

GARDEN'S EXHIBIT OF CYPRIPEDIUMS AT THE NATIONAL ORCHID SHOW, NEW YORK.

THE MRS. WHITELAW REID CUP AWARDED THE GARDEN AT THE NATIONAL ORCHID SHOW.

THE FIVE MEDALS AWARDED THE GARDEN AT NATIONAL SHOWS, 1928.

more attractively if it did not have to be kept in mind that as many as 20,000 people might view the show on a single Sunday afternoon. To overcome partially this difficulty the Trustees have changed the time of opening the Garden on Sundays from one o'clock in the afternoon to ten o'clock in the morning. Also, primarily for the accommodation of a large number of automobilists who are driving through St. Louis on the Fourth of July and Labor Day, the Garden will be open on these two days in the future. Last year it was estimated that as many as 3,000 tourists came to the Garden on these days, only to be disappointed.

ATTENDANCE FOR THE YEAR 1928
(Recording turn-stile count)

	Week-days	Sundays
January	5,513	11,258
February	8,531	18,703
March	23,388	43,254
April	10,658	15,175
May	17,611	17,490
June	25,814	20,478
July	17,795	12,631
August	23,242	19,053
September	20,562	18,942
October	19,706	18,646
November	23,419	44,159
December	15,094	16,950
	211,333	256,739
		211,333
Total		468,072

In March the Director was granted six months' leave of absence by the Board to enable him to visit important botanical institutions and gardens abroad. Two months were spent in travel in northern Africa and southern Europe, especial attention being paid to gardens in Italy. The major portion of the time was spent in the British Isles where practically every botanical garden of importance was visited, together with a number of private and commercial concerns. The Director of the Royal Botanic Gardens, Kew, England, and the officials of the Royal Horticultural Society were untiring in their efforts to make this visit both enjoyable and profitable, and the results of the ideas and information accumulated cannot but be of great value to the Garden in the future. Dur-

ing the absence of the Director, Dr. J. M. Greenman, Curator of the Herbarium, served as Acting Director.

The Name "Missouri Botanical Garden".—Every now and then there appears in the newspapers a protest against what is regarded as a change of the name "Shaw's Garden" to "Missouri Botanical Garden", and visitors to the Garden not infrequently comment upon what they regard as a mark of disrespect to Mr. Shaw in the abandonment of the name "Shaw's Garden." As a matter of fact, the only name which the Garden has ever had, either in the lifetime of Mr. Shaw or since his death, is the "Missouri Botanical Garden." Mr. Shaw, when he erected the original entrance to the Garden in 1858, had cut in stone over the gateway the name "Missouri Botanical Garden," and these stones were incorporated in the new gate built in 1921. In his will, written in 1885, when the plans for the perpetuation of his philanthropy were of course well matured, Mr. Shaw refers repeatedly to the "Missouri Botanical Garden" under that name and definitely states that this is the name which it is to bear. That he regarded this as no change or innovation is evidenced by such statements as, "Whereas I have for many years been engaged in laying out and establishing a botanical garden * * * * and which is now known as the Missouri Botanical Garden." Consequently the legal title and the only name which Mr. Shaw wished to be used is that of the Missouri Botanical Garden, and no greater disrespect to his memory could be shown, even though the Trustees had the power to change the name, than by making its official title "Shaw's Garden." There is of course no reason why popularly it should not continue to be called by citizens of St. Louis "Shaw's Garden," if for no other reason as a mark of appreciation and affection for the founder, but, as stated above, in any official or printed reference to the Garden by those who have the matter in charge the name must continue to be that given by Mr. Shaw.

It is probable that the reason for the misunderstanding regarding the name is due in a large measure to the vastly increased amount of publicity now given to the Garden. In the old days the name "Missouri Botanical Garden" was always used in publications emanating from the Garden or in the slight references made to it in the press, but people

did not have their attention called to the name in the same way that they now do.

European Representative.—Mr. Gurney Wilson, F.L.S., F.R.H.S., Editor of the Orchid Review and Secretary of the Orchid Committee of the Royal Horticultural Society, has been appointed European representative to the Garden. Mr. Wilson's contacts with both the commercial and amateur growers make it possible for him to secure plant material for the Garden which otherwise could not be obtained. Attending as he does most of the important flower shows given in England and on the Continent, he is able to secure novelties which, except for his activities, might be much longer in reaching this country. He can also be of great assistance in securing old books and pamphlets not ordinarily appearing in dealers' lists, and in many other ways not necessary to enumerate.

School for Gardening.—Mr. Shaw in his will directed that in addition to scientific research and instruction in special phases of botany there should also be provided some means of training gardeners. Accordingly the Board of Trustees in 1889 announced its intention of "providing adequate theoretical and practical instruction for young men desirous of becoming gardeners." The plan at first adopted provided that six years be devoted to the training, the first year consisting exclusively of manual labor without any instruction. After trial the course was subsequently shortened to four years and with some slight readjustment remained on this basis until 1914. During this period of eighteen years, twenty-five certificates were awarded to students who had satisfactorily completed the course and some of these have continued in the work, making notable records.

At a meeting of the Board held on March 11, 1914, it was voted to eliminate the year which had previously been devoted to manual labor and to raise the standard of admission as well as the minimum age of entering the school. This necessitated an entire reorganization of the school, much more attention being paid to landscape design and certain other fields, and the courses were standardized in a way which had not previously been possible. In 1919 the Federal Board for Vocational Training of disabled soldiers entered into an arrangement with the Garden whereby men under its charge would receive both practical and theoretical training as gardeners. Because

of the special nature of this work it was not possible to bring the instruction into the formal scheme carried on in the School for Gardening, and what really amounted to a second school was organized which permitted each individual case being handled on its merits. Since the instructional force was in no way increased the addition of this work with disabled soldiers very materially affected the administration of the School for Gardening.

However, experience with the plan adopted in 1914 has demonstrated that pupils of greater maturity and better education do not wish to become gardeners, but are looking toward a professional training in landscape architecture or some closely allied field. These pupils desire to receive a definite degree rather than a certificate. Since there are now available in various parts of the country opportunities for students with the requisite qualifications to obtain instruction in landscape architecture, there does not seem to be the necessity that formerly existed for the Garden to engage in this type of instruction. It is likewise true that the demand for trained gardeners far exceeds that for professional landscape architects. Consequently, at a meeting of the Board held on December 19, 1928, it was voted that the necessary changes be made in the organization of the School for Gardening to meet more nearly present-day demands. An apprenticeship system will accordingly be substituted for the former plan, which will enable those who wish practical experience in gardening methods with a minimum amount of theoretical instruction. These apprentices will qualify as trained gardeners for private estates, parks, cemeteries, country clubs, etc. In addition special short courses are to be organized to meet the popular needs of amateurs in the community who wish instruction along certain lines of gardening. Work of this kind has been carried on for the past two years with a group of students from the School of Occupational Therapy, and there was also organized, at the request of the cemetery superintendents of the city, a special course on plant materials. It is believed that the new arrangement will come nearer to carrying out the wishes of Mr. Shaw as expressed in his will and be of much greater service to the community than a professional school of landscape architecture.

Orchid Seedlings.—In the attempt to secure new hybrid orchids or to obtain at the Garden plants from crosses similar

VIEW OF CHRYSANTHEMUM SHOW, 1928.

GLIMPSE OF POINSETTIA SHOW, 1928.

to those made elsewhere, some 274 crosses were made, but of this number only 48 matured seed. The percentage of successes is about what was expected, since it is a well-known fact that crosses made with parents far removed from the original stock by hybridization seldom produce viable seed. That it is worth while attempting such hybrids, however, is indicated by the successful crosses made between the following orchids of high quality:

Cattleya Trianae var. *gigantea* × *Laeliocattleya General Maude* var. *Victory.*

Cattleya Trianae var. *The Baron* × *Brassocattleya Queen Alexandria.*

Laeliocattleya Wellsiana × *Laeliocattleya General Maude* var. *Victory.*

Cattleya President Wilson × *Laeliocattleya Orien Othello.*

Miltonia Princess Astrid × *Miltonia Kennii.*

Odontioda Hammeral × *Odontioda West Point Beauty.*

Phalaenopsis Reimstadiana, excellent form, × *Phalaenopsis Reimstadiana*, excellent form.

Seed from the following genera with various hybrid forms have been successfully germinated: Cattleya, Brassocattleya, Laeliocattleya, Cymbidium, Dendrobium, Odontioda, Miltonia, Sobralia, Stanhopea, Epidendrum, Phalaenopsis.

Either from pods matured at the Garden or obtained elsewhere some 750 flasks have been sown, and there are now approximately 50,000 seedlings in the early stages of growth. In addition to these, seedlings ready to be transplanted to one-inch pots number about 30,000, and the number of selected seedlings established during the year in one-inch pots is about 8,000.

Floral Displays.—Early in January the Christmas show of poinsettias was removed and a display of primulas staged. By the end of the month the orchids had commenced to bloom at the Gray Summit houses, and these were transported to the floral display house where, combined with baby primroses, they remained throughout the month of February. In some respects this combination made the most artistic orchid display which it has been possible to produce.

The first two weeks of March were devoted to a show con-

sisting exclusively of hyacinths. Hundreds of bulbs were staged in the form of a Dutch garden and produced a novel effect. The second annual spring flower show, under the auspices of the florists and nurserymen of St. Louis, was held in the floral display house March 22-25, inclusive. During these four days over 35,000 persons visited the Garden, and on Sunday, between the hours of 10 a. m. and 11 p. m., the attendance was 25,000 people, thus surpassing any record for a single day in the history of the Garden.

Floral displays throughout the month of April consisted of varied arrangements of standard roses, Schizanthus, Begonias, and Antirrhinums. A display of wild flowers brought in from the Gray Summit Extension once or twice a week attracted much attention and served to familiarize the public with the native flora as it comes into bloom through the season. On May 19 and 20 the annual amateur flower show of the Garden Club of St. Louis was held. This was participated in by numerous amateurs and met with its usual success.

Because of the warm weather in October, early-blooming chrysanthemums came into flower ahead of time, and it was accordingly possible to stage a preliminary display much earlier than the usual show. This lasted from October 27 until November 5. On November 8 the retail florists, assisted by a few of the wholesalers, staged a display of cut flowers, with chrysanthemums, roses, and carnations on successive days. Elaborate booths were constructed, and these, with special arrangements of bouquets, table decorations, etc., made a unique show. On November 11 the florists' show was dismantled and the arrangement of the regular chrysanthemum display began. For the first time bamboo fences, a thatched gateway, small "tori" gates at the front entrance, and an old stone lantern were introduced in this show, all combining to give an appropriate Japanese setting. The range of colors in the chrysanthemums was never so successfully blended, and the perfection of the single-stemmed plants, which exceeded any previously grown at the Garden, made this display even finer than its predecessors. The chrysanthemum show still continues to be the most attractive floral display of the year, the number of visitors attending the five shows from the last Sunday in October to the first Sunday in December exceeding 70,000.

The chrysanthemum show was followed by the usual Christmas display of red, white, and pink poinsettias, Jerusalem cherries, etc. This year, for the first time, the effect of a Spanish patio was produced by the introduction of white walls and arches with a wall fountain at the back. The annual dahlia show inaugurated in 1924 by the Garden was not held this year, the time being left available for a show sponsored by the St. Louis Horticultural Society.

National Flower Shows.—At the National Flower and Garden Show held in Louisville, March 10-18, the Garden staged an exhibit of orchids and pitcher plants which, while not entered in competition, was awarded the National Flower Show gold medal.

On May 10-12, The American Orchid Society held its third National Show in New York City at Madison Square Garden. The Missouri Botanical Garden entered a collection of orchids shipped especially from its Tropical Station on the Canal Zone. In addition cypripediums and pitcher plants from the Gray Summit Extension constituted a part of the display. There was also included an exhibit illustrating the development of orchids from seed to the flowering plant, which was awarded a special gold medal offered by the Horticultural Society of New York for the exhibit of highest educational value. Three gold medals were awarded the Garden by the American Orchid Society, for the pitcher plants, for the collection from Central America, and for the seedling exhibit, and a silver medal for the cypripediums. In addition the exhibit of Nepenthes received the Mrs. Whitelaw Reid silver cup.

Outdoor Planting.—The weather during the spring and summer of 1928 was very favorable for all outdoor planting. There was sufficient rainfall during the summer so that only on a few occasions was watering necessary, and the average temperature was considerably lower than usual. The extraordinary growth which took place during the season is evidenced in an interesting way by the fact that the quantity of leaves collected this fall is three times greater than that of any previous year in the last decade.

The pansies in the English Garden did exceptionally well, blooming more profusely and longer than in past years. In

June they were removed to make way for the annuals, and these in turn were replaced in September by early varieties of chrysanthemums which had been growing in the nursery during the summer. Due to the absence of a killing frost in the fall these chrysanthemums bloomed until late in November.

Considerable work was done in the new iris test garden. During the spring and summer more than a thousand varieties of iris were transferred from the nursery and planted in the test garden. These have become established and in the spring of 1929 most of the varieties should bloom. Many spaces in this test garden are still to be filled, awaiting the varieties to complete the color-planting scheme.

All of the climbing and hybrid perpetual roses bloomed well in June and made splendid growth during the summer. The wood ripened slowly in the fall and with a normal winter should produce many roses again next June. The hybrid tea roses, however, did not do as well. They bloomed during the spring, but later in the season very few flowers appeared. A new shrub-like rose "Sarah Van Fleet," which was introduced in 1926 by the Government in conjunction with the American Rose Society, seems to do unusually well in this climate. This rose is a tall, sturdy plant, and is very hardy. Numerous semi-double pink flowers are produced in spring and during the summer and fall some plants are almost always in bloom.

Construction and Repair Work.—Some fifteen years ago when the main garden was re-landscaped the old greenhouses were removed to a location back of the walls to be used as propagating houses. After the hailstorm in May, 1927, these houses were in such bad condition that the extensive repairs necessary did not seem warranted. Their abandonment reduced the amount of growing space for bedding and other plants very considerably, but the heavy expense incident to the hailstorm made it impossible at the time to replace them. With the contemplated changes in the character of the floral displays it has been evident for some time that additional storage room must be had for plants which are to be forced into bloom for special occasions. Such a house where temperatures can be held lower than is possible in the ordinary greenhouse has long been desired, and late this fall

a start was made toward the erection of a cool house which it is expected will meet all immediate requirements.

The moving of the orchid collection to the Gray Summit Extension necessitates transporting the plants to the city garden at the time of the orchid show. Experience of several years demonstrated that in order to produce the best effects a special house should be provided at the city garden in which to store the plants while they are coming into bloom. Accordingly, the former fruit house was converted into an orchid house, and this necessitated the complete rearrangement of the heating system, together with the construction of new concrete benches.

Tropical Station.—The Superintendent visited the Tropical Station in the Canal Zone early in the year and while there secured several cases of Panamanian and South American orchids. Most of the orchids there have been repotted and the plants are doing well. Additions are constantly being made both from local stations and from abroad, and the collection now constitutes a very important adjunct to the main collection in St. Louis. Some of the low and uneven places in the garden have been filled or leveled, and a croton hedge has been planted to replace the present fence which will have to come down within a year or two. Six cases of Panama orchids were shipped from the garden in April to display at the New York orchid show.

Gray Summit Extension.—Aside from the maintenance of the orchid collection the chief activity at the Gray Summit Extension has been the construction of roads. Much grading and blasting of rock has been attended to, together with the building of necessary culverts, etc., and several thousand loads of gravel hauled from the river have been used. Twelve acres have been sowed to blue grass and covered lightly with straw to prevent washing. Some 15,000 plants have been set out in the nursery and approximately 10,000 transplanted from the nursery into the woods. One hundred additional apple trees have been added to the demonstration orchard, completing the twenty acres set aside for this purpose. Five hundred lineal feet of additional cold frames have been constructed and sowed with seed, chiefly rare tree seed for future supply for the nursery. This last planting comprises 900

species and varieties of trees and shrubs. To provide for watering the nursery and seed beds some 750 feet of galvanized water pipe have been laid. During the fall a trail approximately six and one-half miles long and twelve feet in average width was cut through the woods, opening up a number of unusual vistas. For the first time one can easily pass through different regions of the property and get an idea of the various conditions available which will make possible the naturalization of practically all the plants which can be grown in this climate. A notable start in this direction has been the planting of 2120 rhododendrons and 15,000 narcissus bulbs in what will become the rhododendron dell. Experiments carried on for the past two years indicate that soil and surroundings are suitable for raising rhododendrons successfully, and in time this dell should become one of the most attractive parts of the Extension. Some 200 cedars, varying in size from 2 to 8 feet, were dug and burlapped for future planting along the Manchester Road. This will afford a windbreak for the new pinetum which is soon to be established around the lake.

The old brick house which stood on the Extension at the time of purchase has been remodeled slightly and put in excellent repair for use as an administration building. During the summer it was furnished, using as far as possible odd pieces of furniture which belonged to Mr. Shaw, supplemented by gifts from one of the Trustees.

Annual Bequests.—The annual flower sermon, provided for in Henry Shaw's will to "commemorate the goodness of God as revealed in flowers," was preached on Sunday, May 13, by the Rev. Frank H. Nelson, D.D., of Cincinnati, Ohio.

Complying with the bequest in Mr. Shaw's will providing for "premiums or prizes at a flower show or exhibition," the Garden donated $250 to the annual amateur flower show.

RESEARCH AND INSTRUCTION

The work in research and instruction has gone forward along much the same lines as in previous years. The transfer of a part of the graduate work in the Henry Shaw School of Botany from the Garden to Rebstock Biology Hall on the campus of Washington University, as was mentioned in the report of last year, has relieved temporarily the crowded

condition of the laboratories at the Garden and made it possible to rearrange somewhat the limited floor space to accommodate better that part of the graduate work, particularly in morphology, taxonomy, mycology, and genetics, remaining at the Garden. The work in physiology, cytology, and certain phases of mycology is amply provided for in the spacious and more completely equipped laboratories and lecture halls in the new biology building on the University campus.

Research.—The Curator of the Herbarium, Dr. J. M. Greenman, has carried on his regular curatorial duties as well as investigations on the taxonomy of certain groups of plants and the preparation of "A Flora of the Southwest." He likewise directs the work of the graduate students majoring in taxonomy.

Dr. David Linder, the Mycologist, is engaged in the completion of a monograph of the helicosporous *Fungi Imperfecti* which will appear in the ANNALS some time in 1929. He is likewise making a cytological study of a member of the genus *Saccoblastia*, with the idea that such a study will throw new light on the relations between the *Uredinales* and the *Auriculariales*. Minor work undertaken by the Mycologist includes the perfection of a method for controlling fungus contaminations in orchid-seedling cultures, study of reported cases of "brown patch" in bent-grass lawn, and assistance in determining the cause of diseased plants sent in by outsiders, with recommendations for the control of the trouble.

Dr. Edgar Anderson, Geneticist, has been concerned primarily with questions connected with the problem of species. These studies have progressed to a point where they throw important light on several basic biological concepts, and the first paper on the subject was published in the September ANNALS. Two short papers on Aster are in preparation and the work on Iris is being continued.

The Physiologist, Dr. E. S. Reynolds, is continuing investigations involving the physiological aspects of pathology and will soon complete his work on the toxic effect of certain plant extracts on fungi. The thesis of Miss Ethel T. Eltinge on "The Effect of Ultra-Violet Radiation Upon Higher Plants" was completed during the first part of the year and appeared in the April ANNALS.

The Research Assistant, Dr. Roland La Garde, has been

engaged in a technical investigation of some of the problems involved in the successful germination of orchid seeds. These include the effect of different nutrient media, particularly the different carbohydrates, as well as other chemical compounds, and the specific hydrogen-ion concentration involved. Some tests are likewise under way to determine the effect of certain fertilizers on mature orchid plants. Outside concerns have submitted problems for solution involving tests of fungicides and analyses of various kinds. The daily records of atmospheric pollution have been kept during the year, and these are studied statistically and the results summarized for future use.

Instruction.—Undergraduate and graduate courses offered by the Henry Shaw School of Botany of Washington University in co-operation with the Missouri Botanical Garden for the college year 1927-1928 were twenty-three in number. The schedule of courses during the academic year has been continued with but few changes from last year; and the number of regularly enrolled graduate students has been about the same as in recent years.

The death on February 10, 1928, of Dr. Clifford H. Farr, Associate Professor of Botany in Washington University, was a great loss to the University, and particularly to the Shaw School of Botany. Dr. Farr's class work was taken over for the balance of the college year by Professors Moore and Reynolds and Mrs. Farr. In the summer of 1928, Amos M. Showalter, A.M., Ph.D., University of Wisconsin, was appointed Assistant Professor of Botany in Washington University. Dr. Showalter has assumed charge of Botany 1 and all courses in cytology in the Shaw School of Botany.

Graduates and Fellows.—The following appointments have been made in the Shaw School of Botany for the academic year 1928-1929: Miss Catharine Lieneman, A.B., University of Nebraska, M.S., Washington University, Instructor in Botany (half-time graduate student, Mycology, Physiology, and Pathology); Miss Caroline K. Allen, A.B., Vassar College, Assistant in Botany (half-time graduate student, Taxonomy and Morphology); Miss Martha L. Beardsley, A.B., M.S., Washington University, Assistant in Botany (half-time graduate student, Cytology, Physiology, and Mycology); Hamilton H. Card, A.B., University of Illinois, Assistant in

Botany (half-time graduate student, Taxonomy and Morphology); Miss Josephine Darlington, A.B., B.S. in Forestry, University of Montana, Assistant in Botany (half-time graduate student, Taxonomy and Morphology); Alexander Feodor Bucholtz, B.S., Cornell University, Rufus J. Lackland Research Fellow (Physiology and Cytology); Miss Julia A. Lawrence, A.B., Massachusetts Agricultural College, Rufus J. Lackland Research Fellow (Taxonomy and Morphology); Robert E. Woodson, Jr., A.B., M.S., Washington University, M.A. Harvard University, Rufus J. Lackland Research Fellow (Taxonomy and Morphology); Miss Marion Child, A.B., Oberlin College, Jessie R. Barr Fellow in Botany (Mycology and Cytology); Miss Mildred E. Mathias, A.B., M.S., Washington University, Jessie R. Barr Fellow in Botany (Taxonomy and Morphology); and Mrs. Eva M. Fling Roush, A.B., A.M., University of West Virginia, Jessie R. Barr Fellow in Botany (Taxonomy and Morphology).

Degrees.—The following graduate students in the Shaw School of Botany received advanced degrees at the Washington University Commencement, June 5, 1928: Miss Ethel T. Eltinge, Jessie R. Barr Fellow in Botany (Physiology, Morphology, and Taxonomy)—Doctor of Philosophy (thesis, "The Effect of Ultra-Violet Radiation Upon Higher Plants"); Edward L. Evinger, Rufus J. Lackland Research Fellow (Taxonomy and Physiology)—Master of Science (thesis, "A Revision of the Genus Camassia").

Published Articles.—The results of research and investigation have appeared in the ANNALS OF THE MISSOURI BOTANICAL GARDEN, the quarterly journal which since it was founded in 1914 has so admirably served the members of the staff and graduate students of the Henry Shaw School of Botany as a place of publication. During the year four numbers of the ANNALS have been issued; these contain the following articles:

Kobuski, Clarence E. A New Genus of the Acanthaceae. Ann. Mo. Bot. Gard. **15**[1]:1-8, *pls. 1-2.* 1928.

Kobuski, Clarence E. A Monograph of the American Species of the Genus Dyschoriste. Ann. Mo. Bot. Gard. **15**[1]:9-90, *pls. 3-16.* 1928.

Mathias, Mildred E. Studies in the Umbelliferae. I. Ann. Mo. Bot. Gard. **15**[1]:91-108, *pls. 17-19.* 1928.

Linder, David H. Concerning the Status of the Genus Laternea. Ann. Mo. Bot. Gard. **15**[1]:109-112, *pl. 20*. 1928.

Gainey, P. L. Sources of Energy for Azotobacter, with Special Reference to Fatty Acids. Ann. Mo. Bot. Gard. **15**[2]:113-168, *figs. 1-5*. 1928.

Eltinge, Ethel T. The Effect of Ultra-Violet Radiation Upon Higher Plants. Ann. Mo. Bot. Gard. **15**[2]:169-240, *pls. 21-33, figs. 1-2*. 1928.

Anderson, Edgar. The Problem of Species in the Northern Blue Flags, *Iris versicolor* L. and *Iris virginica* L. Ann. Mo. Bot. Gard. **15**[3]:241-332, *pls. 34-44, figs. 1-21*. 1928.

Larsen, Esther L. A New Variety of Vernonia Lindheimeri. Ann. Mo. Bot. Gard. **15**[4]:333-334, *pl. 45*. 1928.

Woodson, Robert E., Jr. Dysosma: A New Genus of Berberidaceae. Ann. Mo. Bot. Gard. **15**[4]:335-340, *pl. 46*. 1928.

Woodson, Robert E., Jr. Studies in the Apocynaceae. II. A Revision of the Genus Stemmadenia. Ann. Mo. Bot. Gard. **15**[4]:341-378, *pls. 47-49, figs. 1-2*. 1928.

Woodson, Robert E., Jr. Studies in the Apocynaceae. III. A Monograph of the Genus Amsonia. Ann. Mo. Bot. Gard. **15**[4]:379-434, *pls. 50-53, figs. 1-2*. 1928.

In addition to the above the following articles by members of the scientific and Garden staff have appeared in other than Garden publications:

Greenman, J. M. Botany. (The American Year Book for 1927, pp. 651-655. 1928).

Jensen, L. P. Native Woody Plants of Unusual Adaptability. Parks and Recreation **11**:180-181. 1928.

Jensen, L. P. Naturalizing Native Plants. Parks and Recreation **11**:249-251. 1928.

Jensen, L. P. Wild Flowers of the Garden. Garden Life **1**[3]:4. 1928.

Pring, G. H. Cactus as a Hobby Plant. Garden and Home Builder **46**[5]:438, 471, 477. 1928.

Scientific and Popular Lectures.—The scientific and popular lectures given during the year before various organizations are as follows:

Edgar Anderson, radio talks over Station WIL, January 23, "The Missouri Botanical Garden," January 30, "Plant Explorers," February 6, "Plants and People," February 13, "The Development of a New Spray," February 20, "Botany and Business," February 27, "A Plant Explorer";

March 8, before the Parent-Teachers Association of Glendale, on "Camping and Tramping in England"; March 9, before the Webster Groves Nature Study Society, on "Camping and Tramping in England"; March 13, before the Better Homes Group of the Monday Club of Webster Groves, on "Garden Irises"; March 14, before the Phi Sigma Biological Society, on "The Problem of Species"; April 2, before the Webster Groves Nature Study Society, on "Spring Wild Flowers"; April 5, before the Woman's Chamber of Commerce, on "Plant Life," illustrated with moving pictures; October 5, before the Webster Groves Nature Study Society, on "The Wider Possibilities of Nature Study"; November 23, before the Kirkwood Garden Club, on "Irises for the Home Garden."

J. M. Greenman, December 27, before the Systematic Section of the Botanical Society of America, New York City, on "Some Early Collections in the Missouri Botanical Garden Herbarium."

L. P. Jensen, January 27, before the Methodist Church at Gray Summit, Missouri, on "Conservation of Native Plants"; February 17, before the Kellogg Wild Flower Society, St. Louis College of Pharmacy, on "The Flora of the Limestone Glades"; May 3, before the St. Louis Horticultural Society, on "Native Plants"; June 3, before the St. Louis Association of Gardeners, on "The Missouri Botanical Garden Extension"; July 11, before the St. Louis Association of Cemetery Officials, on "The Missouri Botanical Garden Extension"; August 3, before the Osage Hills Garden Club, on "Wild Flowers"; November 23, before the Faculty of the St. Louis University Medical College, on "The Missouri Botanical Garden Extension"; November 24, before the Osage Hills Garden Club, on "Lawns and Ornamental Plantations"; December 7, before the St. Louis Horticultural Society, on "Winter Gardening."

Paul A. Kohl, March 30, before the Carondelet Branch of the Young Men's Christian Association, on "Spring Gardening."

R. V. La Garde, May 11, before the General Seminar, Shaw School of Botany, on "The Germination of Orchid Seeds."

Catharine Lieneman, December 28, before the Mycological

Section of the Botanical Society of America, New York City, on "A Statistical Study of Hosts of Cercospora."

David H. Linder, April 18, before the Phi Sigma Biological Society, on "A Trip to British Guiana."

Mildred E. Mathias, December 27, before the Systematic Section of the Botanical Society of America, on "Generic Limitations in the Umbelliferae" (read by title).

George T. Moore, January 9, before the Rochester Section of the American Chemical Society, at Rochester, New York, on "Unnecessary Smoke: A Menace to Life, Property and Pursuit of Happiness"; February 2, before the St. Louis Academy of Science, on "The Application of the Moving Picture to Scientific Work"; April 3, before the students of the American University, Cairo, Egypt, on "Some of the Activities of the Missouri Botanical Garden"; September 7, before the Executives Club of St. Louis, on "The Work of the Missouri Botanical Garden"; October 11, before the women of the Union Avenue Christian Church, on "The Service of the Missouri Botanical Garden to the Public"; October 20, before the Faculty Club of Washington University, on "Some Impressions of My Recent Trip Abroad"; November 27, before the Garden Club of St. Louis, on "The Most Unique Garden in England"; December 3, before the Current Topics Club, on "Morality in Plants"; December 10, before the St. Louis Country Day School, on "The Plant Commonwealth"; December 12, at the annual dinner of the Phi Sigma Biological Society, on "Newspaper Science."

George H. Pring, March 1, before the Collinsville High School, Collinsville, Illinois, on "Plant Collecting in Central America"; March 27, before the Nashville Woman's Club, Nashville, Illinois, on "Orchid Exploration"; April 3, before the Men's Club of the Clifton Heights Presbyterian Church, on "The Missouri Botanical Garden Tropical Station, Panama"; April 6, before the pupils of the Yeatman High School, and April 11, before the pupils of the Normandy High School, on "Trees"; May 2, before the St. Louis Association of Gardeners, on "The Missouri Botanical Garden Tropical Station, Balboa"; May 24, before the North Side Optimists Club, on "Orchid Exploration"; July 10, before the Alton Kiwanis Club, on "Orchid Exploration in Central America"; October 8, before the University City Masonic Temple Women's Club, on "Orchid Exploration";

October 10, before the St. Louis Association of Gardeners, on "Spraying"; October 12, before the South Kirkwood Garden Club, on "Fall Planting"; December 20, before the Men's Club of the Florissant Methodist Church, on "Orchid Exploration."

Ernest S. Reynolds, December 27, before the Physiological Section of the Botanical Society of America, New York City, on "Extracts of Flax Toxic to Fungi."

Hermann von Schrenk, April 2, before the Engineering Faculty, University of Illinois, Urbana, on "Problems of Engineering—A Biological Viewpoint"; April 3, before the Civil Engineering Department, University of Illinois, Urbana, on "Timber as an Engineering Material"; May 8, before the South Side Lions Club, on "Gardening"; May 11, before the St. Louis Horticultural Society, on "Transplanting Trees and Shrubs."

Robert E. Woodson, Jr., December 27, before the Systematic Section of the Botanical Society of America, New York City, on "Distributional Problems in Amsonia."

Research in Progress.—The problems under investigation embrace primarily the fields of Cytology, Genetics, Horticulture, Morphology, Physiology, and Taxonomy, in their various ramifications.

HERBARIUM

The growth and development of the herbarium during the year 1928 have continued satisfactorily. The amount of new material acquired has exceeded slightly that received in 1927. The current accessions represent the flora of such widely separated geographical areas as southeastern Europe, Mongolia, eastern China, New Caledonia, various parts of North America, Mexico, the West Indies, and South America. The Garden representation of the flora of tropical America has been supplemented more substantially than has that of other parts of the world; yet, as during the past ten or fifteen years, attention and resources have been centered largely on the flora of the southwestern part of the United States.

New Accessions.—The larger and more important collections obtained during the year are the following: Dr. E. Anderson, 74 plants of eastern United States; Arnold Arboretum, 329 plants of Europe, New Caledonia, and Cuba; Botanischer Garten und Museum, Berlin, Germany, 200

plants of Bolivia, collected by Dr. José Steinbach; W. E. Broadway, 450 plants of Trinidad and Tobago; Alexander F. Bucholtz, 500 fungi of Russia, namely, "Fungi Rossici Exsiccati"; B. F. Bush, 255 plants of Missouri; Miss Marion Child, 68 plants of New Mexico; College of the Pacific, by Professor E. E. Stanford, 100 plants of California; Professor Delzie Demaree, 301 plants of Arkansas; Professor J. A. Drushel, 200 plants of eastern United States; Dr. Carl C. Epling, 463 photographs of type specimens; Dr. H. A. Gleason, 84 plants of British Guiana; E. W. Graves, 1300 plants of the United States; Gray Herbarium of Harvard University, 137 plants of Margarita Island, Venezuela, collected by Miller and Johnston; A. A. Heller, 100 plants of California; Dr. Guillermo Herter, 125 plants of Uruguay; Jardin Botanique de Nikita, Taurica, U.S.S.R., 61 plants of Taurica; Dr. A. M. Johnson, 165 plants of the Chippewa National Forest, Minnesota; John H. Kellogg, 819 plants of Missouri; Miss Esther L. Larsen, 184 plants, mostly from Montana and North Dakota; Dr. Miguel Lillo, 120 plants of South America; Dr. David H. Linder, 41 fungi, mostly from Missouri; Masaryk University of Brno, Czechoslovakia, by Professor Dr. Jos. Podpera, 100 plants of Czechoslovakia; Miss Mildred Mathias, 49 plants from Missouri and Vermont; Dr. William R. Maxon, 89 plants of Haiti, collected by W. J. Eyerdam; Professor E. D. Merrill, 178 plants of Mongolia, collected by Dr. Ralph Chaney, 190 plants of China, collected by F. P. Metcalf, and 673 plants of Indo-China, collected by Mrs. M. S. Clemens; Franklin P. Metcalf, 765 plants of the Province of Fokien, China; Mrs. Ynez Mexia, 895 plants of Mexico; W. Migula, 150 algae, fungi, and lichens of Germany, Austria, and Switzerland; Museu Paulista, Sao Paulo, Brazil, by Dr. F. C. Hoehne, 36 Senecios of Brazil; New York State Museum, by Dr. Homer D. House, 129 plants of New York; Rev. Hugh O'Neill, O.S.B., 121 plants of Florida; Dr. F. Petrak, 100 fungi, namely, "Mycotheca generalis"; Dr. H. Pittier, 320 plants of Venezuela; Philadelphia Academy of Natural Sciences, by Dr. F. W. Pennell, 150 plants mostly of southern New Jersey; Robert Ridgway, 68 plants of Illinois; Frank C. Seymour, 100 plants of the Mexican Gulf Coast; Professor Robert Stratton, 617 plants of Oklahoma; W. N. Suksdorf, 314 plants of Washington; J. W. Thompson, 2,525 plants of Oregon;

United States Department of Agriculture, by Dr. A. S. Hitchcock, 91 grasses from Bolivia; University of Montreal, by Brother Marie-Victorin, 299 plants of Canada; University of Pennsylvania, by John M. Fogg, Jr., 290 plants of eastern United States; University of Wisconsin, by Dr. N. C. Fassett, 137 plants of eastern United States; S. Venturi, 758 plants of Argentina; Theodor Oswald Weigel, 750 plants of Bolivia, collected by Dr. O. Buchtien, and 162 fungi of Europe; and C. A. Wenzel, 300 plants of the Philippine Islands. Numerous smaller collections have been received from correspondents and friends of the Garden, which have been recorded in current numbers of the BULLETIN.

Mounting and Distributing.—The mounting of specimens has continued throughout the greater part of the year, although less than one-half of the total number of specimens received has been mounted. The distributing of newly mounted specimens, except for certain groups of plants, has kept nearly apace with the mounting, so that most of the material mounted during the year is already inserted in the organized part of the herbarium. The lichens, mosses, and a few other groups are placed temporarily in storage pending the installation of more herbarium cases.

Reorganization of Specimens in the Herbarium.—It has been necessary during 1928, as in previous years, to devote a large amount of time to the reorganization of material already in the herbarium. Many specimens have had to be remounted either in part or *in toto*, worn and soiled genus covers replaced, labels amplified, and the specimens rearranged in accordance with a definite geographical sequence, in order to put the collections in proper condition for comparison and study by members of the staff, the graduate students, and visiting botanists. This phase of the herbarium work is necessarily very slow, because it can be done satisfactorily only by an experienced individual, and one having consecutive time, adequate room, and ample table space. Notwithstanding the fact that considerable increased case capacity was provided in 1926, the large amount of new material added to the collection in the intervening time has resulted in such a congestion that damage to specimens resulting from excessive crowding can be alleviated only by the installation of additional cases.

Field Work.—The amount of field work carried on during the past year has been limited, although some local collecting has been done to supplement the herbarium, to provide material for class work, and to furnish duplicates for the purpose of exchange.

Exchanges.—The number of duplicate specimens sent to institutions and individual correspondents with whom the Garden maintains exchanges has been about the same as in 1927. The preparation of duplicate material, the identification of species, the sorting and labeling of specimens require much time and painstaking work. The distribution of duplicates, however, has been pushed forward as time has permitted, and the exchange account has been kept in balance as far as possible.

Use of the Herbarium by Outside Botanists.—Each year for several years there has been a constantly increasing number of visiting botanists to consult the herbarium. During 1928 the number of out-of-town botanists who have consulted the Garden collections has been somewhat larger than usual. Several loans of herbarium specimens have been made to institutions during the past year for study by specialists and research students. Loans also have been made to the Garden for study by members of the staff and by advanced graduate students in connection with their research problems. Such interchange of herbarium material, when conducted with discretion, not only facilitates the work of the party immediately concerned but advances our knowledge of plants, and incidentally enhances the scientific value of critically studied specimens.

Statistical Summary (For the year ending December 31, 1928).

Number of specimens received on new accessions:

By purchase	12,124	
By gift	1,389	
By exchange	2,745	
By field work	439	
Total	16,697	valued at $1,669.70

Number of specimens mounted and incorporated	6,942	valued at $1,388.40

Number of specimens discarded from the herbarium	158	without value	
Number of specimens in organized herbarium	948,363	valued at	$151,606.00
Number of specimens in unorganized herbarium	104,629	valued at	9,119.56
Wood specimens, etc., supplementing the herbarium		valued at	280.00
Microscope slides		valued at	410.00
Total valuation			$161,415.56

LIBRARY

Although the number of library accessions for 1928 is not as large as for 1927, practically all the books and pamphlets catalogued the last year have had a direct relation to botany or horticulture. Many books representing allied sciences, such as zoology, chemistry, physics, etc., have been added to the library from time to time, but recently the policy has been adopted of eliminating all unbotanical material that is accessible elsewhere in the city. This was done chiefly to conserve space, since the stacks have become extremely crowded. After the library walls had been cleaned in the spring, advantage was taken of all the books being moved to shift those in two of the rooms to gain space in a crowded section. This was the last possible space that could be found with the present arrangement, and at the normal rate of expansion these cases would be filled in less than a year.

The last year has been notable in the library for improvements in equipment. Chief among these are the new steel cases for accession slips. Since the beginning of the library the record of new accessions has been kept on slips which were filed in patented pasteboard boxes. As these boxes had become overcrowded and worn-out, new steel boxes were purchased which contain almost twice as much room as the old ones and are much more durable.

The smoky atmosphere of the city has had an effect on the books at the Garden. Many of the bindings on the old folios were in a dilapidated condition, but as the books were in constant use and extremely valuable it was never felt that they could be spared from the library. The problem was finally solved by engaging two bookbinders to do the work at the Garden. Ninety-one books were repaired or rebound by them, including the rare sets of Martius' "Flora Brasili-

ensis'' and ''Flora Danica.'' It is hoped, by having these binders for a few weeks every year, that soon all the books needing repair will be in a good condition.

In July the Annals reprints were mailed out. Since this is only done every two years and the addresses of the botanists receiving them are liable to change in that length of time, all the names were first checked with American and foreign address books or membership lists. Twenty-five hundred reprints were sent to 280 botanists, each receiving the publications in his special field of botany.

Ue of the Library.—Besides the students and teachers in the Henry Shaw School of Botany, students from near-by institutions frequently refer to books in the Garden library in their preparation of reports or theses. Specialists from out of town also consult the library in working up monographs, etc., since there is much material here that cannot be obtained elsewhere. Among the out-of-town visitors last year were the following: Dr. Earl E. Sherff, instructor in botany, Chicago Normal College, Dr. C. C. Epling, instructor in botany, University of California, Southern Branch, Prof. H. W. Rickett, assistant professor of botany, University of Missouri, Profs. Robert Stratton and H. I. Featherly, of Oklahoma Agricultural College, Dr. Ivan M. Johnston, of the Gray Herbarium of Harvard University, Dr. Christobal M. Hicken, professor of botany, University of Buenos Aires, Prof. A. T. Erwin, associate professor of horticulture, Iowa Agricultural College, Mr. A. Saeger, teacher of botany, Kansas City Junior College. In addition Prof. H. W. Rickett, of University of Missouri, and Prof. L. A. Kenoyer, of Western State Normal School, Kalamazoo, Michigan, chartered busses and brought the botany students of their respective institutions to visit the library and herbarium. The University of Illinois library school also spent an afternoon at the Garden library during its biennial inspection of libraries last spring.

The library lends books outside the Garden only on the interlibrary-loan plan, 146 such loans being made to 31 institutions in 1928.

New Accessions.—Although the book-dealers' catalogues have been listing especially valuable publications, most of the botanical items are already contained in the library. The Garden was fortunate, however, in obtaining during the

year a copy of Rafinesque-Schmaltz' "Caratteri di alcuni nuovi generi en species animali e plante della Sicilia," a rare work seldom advertised. Other purchases in 1928 worthy of note were the following: Bateson, William Bateson, F.R.S., naturalist; all the lacking reports of the Botanical Society & Exchange Club of the British Isles; Buchanan & Fulmer, Physiology and biochemistry of bacteria; Clark, Determination of hydrogen ions, 3rd edition; Coker & Couch, Gasteromycetes of the eastern United States and Canada; Emick, Lehrbuch der Mikrochemie; Fischer, Untersuchungen über Aminosauren, Polypeptide und Proteine; Goldschmidt, Einfuhrung in die Vererbungs-wissenschaft, and Physiologische Theorie der Vererbung; Gotheim, History of garden art; Hirmer, Handbuch der Palaeobotanik, Vol. 1; Kirk, A British garden flora; Krause, Enzyklopaedie der mikroskopischen Technik, Vols. 1-3; Internationale Kongresses für Vererbungswissenschaft, Vols. 1-2; Jordan & Falk, The newer knowledge of bacteriology; McKelvey, The lilacs; Migula, Die Pilze, pts. 1-88; Plant buyers index; Sarton, Introduction to the history of science; Schaffnit, Forschungen aus dem Gebiet der Pflanzen, and Krankheiten und d. Immunitat im Pflanzenreich; Sutton, Volumetric analysis; Wilder, Pleasures and problems of a rock garden; Wilson, Plant hunting, Vols. 1-2; Warner, Select orchidaceous plants, Vols. 1-2.

Many other valuable books and pamphlets are received as donations or in exchange for the Garden's publications.

Garden Publications.—During the year the four numbers of Volume XV of the ANNALS were issued. The volume contains 437 pages, 53 plates and 37 text-figures. The exchange list of the ANNALS is steadily growing, and the number of copies printed had to be increased in 1928. Most of the requests for exchanges came from the Soviet Republics, but institutions of France, England, Germany, Hungary, Australia, Dominica, East Africa, Canada, and the United States were added to the ANNALS mailing list the last year.

Volume XVI of the monthly BULLETIN was completed in 1928, with 151 pages and 44 plates. Both the ANNALS and BULLETIN are sold to subscribers, $1885.75 being received during the year from the sale of these two publications, reprints of ANNALS articles, and BOOKS OF VIEWS.

Statistical Information.—There have been donated to the library or received in exchange during the year 395 books, valued at $977.30; and 3549 pamphlets, valued at $661.77. Four hundred and six books were bought at a cost of $1973.91, and 116 pamphlets at a cost of $248.03. The library now contains 44,119 books and 67,221 pamphlets, a total of 111,340. There are also 331 manuscripts valued at $1614.80 and 963,423 index cards valued at $11,158.22. A total of 9218 cards were added during the year, of which 2112 were written by Garden employes and 7106 bought at a cost of $147.27. Four hundred and ninety-one books were bound or repaired.

GEORGE T. MOORE,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1928

GARDEN ATTENDANCE:

Total number of visitors	32,044

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	45
Total number of books and pamphlets donated	1,022

PLANT ACCESSIONS:

Total number of seed packets donated or received in exchange	30

PLANT DISTRIBUTION:

Total number of plants distributed in exchange	21

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad and Tobago, B. W. I.	100
Venturi, S.—Plants of Argentina	758

By Gift—

Anderson, Dr. E.—Seeds of *Talinum rugospermum* from Wisconsin	1
Dougan, Prof. L. M.—*Abies* sp. from St. Louis markets	1
Pring, Geo. W.—*Cycnoches Warscewiczii* Reichb. f. from horticulture, originally collected in Panama	1
Stokes, Prof. James R.—*Angelica dentata* (Chapm.) Coulter & Rose from Georgia	1

By Exchange—

Museu Paulista, by Dr. F. C. Hoehne—Plants of Brazil	36
Stratton, Prof. Robert—Plants of Oklahoma	617

By Field Work—

Kellogg, John H.—Plants of Missouri	200
Total	1,715

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Missouri Botanical Garden Bulletin

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HAZELWOOD—VIEW FROM TERRACE.

Missouri Botanical Garden Bulletin

Vol. XVII FEBRUARY, 1929 No. 2

NOTABLE ST. LOUIS GARDENS

III. Hazelwood: The Garden of Mrs. S. W. Fordyce

In many ways Hazelwood reminds one of an English Garden. It is set back far away from the highway and one approaches it down a tree-lined avenue; the garden itself is close to the house and almost a part of it, and the rest of the world is shut out by large trees which throw their patterns of light and shade across the flower beds and the paths. It is English, too, in that the garden and the house have grown up with one another and have that air of belonging together which is so seldom achieved in American gardens.

The flower gardens are set semi-formally to align with the house and terrace and form an attractive background at all times of the year. As far as the flowers themselves are concerned, however, it is frankly a one-season garden, for it is made up almost entirely of spring-flowering perennials. In iris time the garden is at its best. Then it is that one can stand on the terrace before the front door and look past bright groups of flowering perennials to the great banks of iris which fill in the background.

One of Hazelwood's most notable features is the use of color. In many of the plantings a clever combination of color has been made to conceal defects in one flower or to bring out hidden beauties in another. There are, for instance, no irises which are really pink; even the pinkest of them have a tinge of blue. At Hazelwood the Dropmore variety of Anchusa has been planted next to the common Iris Her Majesty. The blue of the iris has been drowned out by the

brighter, truer blue of the Anchusa, and one's eye sees only the pale pink in the iris. Even more clever is Mrs. Fordyce's use of Anchusa as a foil for Iris QUAKER LADY. The latter, if one looks closely enough, is a lovely blend of browns and blues. Seen at a distance, or passed by with a glance, the main effect is a smudge of the two. It is really a lovely iris but has to be seen in the right company to be appreciated. By planting it next to Anchusa, the blue is repeated and emphasized, so that the main impression of the flower is bright and clear.

Hazelwood has a fine general selection of spring-flowering perennials but they are all eclipsed when the oriental poppies come into flower. These latter are the garden's main feature and they are everywhere, some twenty named varieties of them, in all shades of red and pink and white. They have been used generously in the perennial gardens, and long rows of seedlings fill what started out as a vegetable garden but is now chiefly a poppy nursery. Not satisfied with the varieties already on the market, Mrs. Fordyce has grown many seedlings of her own, several of which have been distinctive enough to merit a variety name. CARNIVAL is a very early pink, and FIRST PRIZE PINK and HAZELWOOD DREAM are two other varieties of the same color. Two promising seedlings have as yet no name. One of these is a seedling of PERRY'S WHITE, and in appearance it is much like the parent variety, but sturdier and much less difficult to grow. The other is of a peculiar shade which can only be described as mulberry. It is a distinctive color and should prove generally useful in the perennial border.

Mrs. Fordyce has grown oriental poppies so long and so successfully that her advice will be generally helpful to St. Louis gardeners. She feels that many people fail with oriental poppies by disturbing them needlessly during their dormant period. After flowering time the leaves die down completely and do not start up again until well into the fall. If they are in a bed with other perennials, care should be taken that they are not injured at this time. The next most important point is a careful inspection of the plants after they start growth in the fall. They are prone to root dis-

HAZELWOOD: VIEWS IN PERENNIAL GARDEN.

eases, and those which are affected will show up at that time by their poor growth and yellow leaves. Inspection will usually show the disease to have reached only the central portion of the roots. If it is cut out with a spade and the hole filled in with fresh earth, the remaining small roots will propagate themselves if left undisturbed. By the next year there should be several young plants which can then be divided and set out in their permanent places.

Oriental poppies are one of the few perennials which can be grown easily from root cuttings, and Mrs. Fordyce increases many of her varieties in that way. The roots are merely cut into small lengths of from an inch and a half to two inches, which are treated like ordinary cuttings. It is important that they should not be placed upside down. Even though they are detached from the parent plant, the directions of up and down seem to be fixed in the cutting. The upper end of the cutting will produce only leaves, the lower end only roots. Mrs. Fordyce has used two rooting mediums. At first she tried sphagnum moss, but for the last two years she has rooted her cuttings in a mixture of peat-moss and sand, which seems to give even better results.

Cuttings take two years to develop into flowering plants; that is, cuttings made in the fall of 1928 will not flower until the spring of 1930. Very husky cuttings may flower the first summer but the bloom will not be of normal size.

Mrs. Fordyce has had even more interesting experiences in attempting to flower another member of the poppy family, *Romneya Coulteri.* It is a tall perennial with great white and gold blossoms six inches across. It is native to southern California and extremely difficult to transplant. The books said that it could be grown from fresh seed and so Mrs. Fordyce sent to California for a supply. She planted it as soon as it was obtained, but no seedlings came up . She got another lot of seed and tried again, but with the same discouraging result. She wrote to California in the attempt to get fresher seed or even young seedlings. In this, too, she was unsuccessful, but a fact casually mentioned in one of the letters set her to thinking. "I may be able," wrote her correspondent, "to get you some small seedlings by visiting a

recent 'burn', for Romneya always comes up right after forest fires.'' That gave her a hint as to what might be the trouble. The idea seemed fantastic, but is was worth trying. She obtained a new lot of seed and planted two pots with it—two pots exactly alike in every respect. One she treated as she had all the previous ones; the other she covered with a handful of excelsior which she then set on fire. If forest fires helped the seed to germinate in California, why not try a small forest fire on the seed pot? Then days of waiting. Then partial success, for the seeds came up in the fired pot and not in the untreated one. But why call it a partial success? Because, while the seeds germinated and the seedlings grew, it has not yet been possible to make them flower in our climate. So Hazelwood has not yet seen the great gold-centered flowers, but Mrs. Fordyce is not through with her experiments and she hopes that by duplicating the droughts and rainy seasons of California, she may be able, at last, to have flowers of Romneya.

A WINTER-FLOWERING SHRUB NATIVE TO MISSOURI (HAMAMELIS VERNALIS)

One of the most interesting shrubs of the whole world is hidden away in the valleys of southern Missouri; hidden so effectively that it was not named and recognized by botanists until 1911, and is even now, in spite of its astonishing habits, unknown to the general public. How many St. Louisans, for instance, realize that on every warm day in February there are hundreds of thickets in the southern part of the state which are fragrant with flower perfume as rich and spicy as that of any orchid?

Such is indeed the case, and Missouri's earliest flower is not the snowdrop or the crocus, but a much earlier one, the vernal witch-hazel, *Hamamelis vernalis* Sarg. Witch-hazels get their name because of a general resemblance to the true hazels and because their branches are used in divining or ''witching'' for water. They were supposed to have magical powers, a supposition borne out by the fact that they have medicinal properties. An infusion of the bark of our common

HAMAMELIS VERNALIS IN WINTER CONDITION.

FLOWERING BRANCHES OF HAMAMELIS VERNALIS.

northern species, *Hamamelis virginiana*, is the source of the witch-hazel of commerce. The term "witch" would seem to be particularly appropriate in the case of *H. vernalis* for it upsets all established traditions in its manner of flowering.

Like its relative, the common witch-hazel, the flower buds are formed during the late summer but it does not, like that species, open them during the fall. Instead, they remain on the bare shrub as tight little balls and it is not until well into February or January that they flower. Then with the first warm spell, their little woolly caps split open and the queer twisted petals unroll. If the day is none too warm they enroll only part way and roll back at night. This alternate opening and closing they keep up for several weeks; unrolling their tawny petals during warm spells and rolling them up again during colder weather. There are four petals in each flower, like four little streamers of crepe paper, set in a calyx cup which is reddish within and woolly brown without. In color and shape the flowers vary tremendously from bush to bush. One specimen will have lemon-yellow flowers, another orange ones, some dull red. All of these are colors which make for great beauty when the flowers are brought indoors and seen against a flat background. Out of doors they merge into a general tawny haze and are hardly visible from any distance. They are, as a matter of fact, so inconspicuous that on a fine afternoon they can be smelled much farther than they can be seen.

The perfume is really the most surprising thing about the species. It is rich and sweet, often with a spicy tinge like that of nutmeg. Altogether it is more like what we would expect to find in a humid tropical jungle and not in the gravelly bed of a Missouri creek.

Nor is such a perfume characteristic of witch-hazels as a group. Some of the Asiatic species bloom early in the spring but they are not really fragrant. The genus Hamamelis has about five species, all of which are of garden merit and are of general interest. *Hamamelis virginiana* is the common species of eastern North America and is found in northern Missouri. The vernal witch-hazel is distinguished from it chiefly by the color of its flowers and its time of flowering.

Furthermore, it has a habit of forming thickets along creek beds, while its northern relative is found singly in damp woods. The leaves are also quite characteristic. They are much more downy in the vernal witch-hazel and have a curious habit of hanging on the bush until late in the winter. It is by these persistent withered leaves that the species can be recognized at a distance at flowering time. Many of the creek beds in the neighborhood of Farmington, Mo., are crowded with thickets of *H. vernalis*. In sheltered situations the dead leaves hang on in large numbers and give the thicket an unkempt appearance that conceals the beauty of the flowers from the casual passer-by.

The Asiatic species, *Hamamelis japonica* and *H. mollis*, also flower in the very early spring. *H. mollis* is a bush, *H. japonica* becomes a small tree. Both have been introduced into this country and are occasionally seen in northern gardens. In 1927, the Garden obtained scions of both species and grafted them on a bush of the vernal witch-hazel. They have both grown well but have as yet produced no flower buds. In a few years they will probably be large enough to do so and then every spring will find a curious bush at the Garden, bearing three kinds of flowers. One branch will bear Chinese witch-hazels, one Japanese, and the rest of the bush will have the tawny flowers of our own Ozark species, *H. vernalis*.

SPECIAL COURSES IN GARDENING FOR AMATEURS

As announced in the January, 1929, BULLETIN, a change has been made in the form of work offered in the School for Gardening, so that short special courses of a practical nature can now be offered to those interested in one or more of the various aspects of gardening. These courses are designed, in so far as possible, to meet the needs and desires of amateurs in St. Louis, and for the present are strictly elementary in character. The following outline has been tentatively prepared for work to be given in the spring of 1929, in accordance with suggestions thus far received. An attempt will be made to arrange new courses for any group indicating the particular field they wish covered.

1. *Elementary Gardening*—Planning flower and vegetable gardens. Checking catalogues. Equipment. Sowing seeds and transplanting and caring for seedlings. Insect and fungus pests. Propagating by cuttings, layering, division, etc.
Tuesdays and Thursdays, 4:00 to 5:00 p. m. Registration. March 5, 3:45 p. m. (Kohl)

2. *Identification of Plants, Local Spring Flora*—Simple, but essential facts necessary for the naming of common wild flowers. Use of books. Field trips. Making an herbarium.
Saturday afternoons, March-June. Registration, March 9, 1:30 p. m. (Anderson, Kellogg)

3. *Vegetable Growing*—Preparation of soil. Sowing, planting, cultivation, etc. A small plot of ground will be assigned to each pupil.
Tuesdays and Thursdays, 9:00 a. m. to 12 m., April-June. Registration, April 2. (Anderson, Gilmour)

4. *Iris*—Demonstration in the iris garden. Varieties, propagation, diseases, etc.
Saturday morning, May 18, 9:00 a. m. (Kohl)

5. *Bent Grass Lawns*—Varieties, planting, care, etc.
Saturday afternoon, May 25, 1:30 p. m. (Pring)

6. *Roses*—Varieties. Propagation, pruning, diseases, fertilizers, etc.
Saturday morning, June 1, 9:00 a. m. (Kohl)

Registration—No previous notice of intention to join a course is necessary. Report promptly at the main entrance (Tower Grove and Flora Place) on the day and hour indicated for the course. Register in the office at the main entrance. In case it is agreeable to the instructor and all those applying for the course, a change in the day and hour may be made *after* the first meeting. Bring note-book and pencil.

Fees—A fee of five dollars each for courses 1, 2 and 3 will be charged. For the demonstration on iris, roses, and bent grass lawns, a fee of one dollar will be charged. Fees are payable at the time of registration.

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1929

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before planning to visit the Garden.

JANUARY

(Floral Display House)

Primulas

FEBRUARY

(Floral Display House)

Orchids, Camellias, Cinerarias

MARCH

(Floral Display House)

Bulb show. Native flowers from Gray Summit Extension.

14th to 17th, Spring flower show sponsored by the St. Louis Florists.

APRIL

(Floral Display House)

Azaleas. Rhododendrons.

Native flowers from Gray Summit Extension.

(Outdoors)

Pansies, English daisies, Early-flowering shrubs.

MAY

(Floral Display House)

Hybrid Pelargoniums, Salpiglossis, Begonias.

Special Iris Display.

(Outdoors)

Bulbs (early in month), Hardy water-lilies, Peonies.

Iris (late in month), Spring-flowering shrubs and perennials.

JUNE

(Floral Display House)

What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.

(Outdoors)

Roses, Hollyhocks. Medicinal Garden.

JULY

(Floral Display House)

What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.

(Outdoors)

Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST

(Floral Display House)

What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.

(Outdoors)

Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER

(Outdoors)

Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER

(Floral Display House)

Dahlia Show (novelties and newer varieties).

NOVEMBER

(Floral Display House)

Chrysanthemum Show.

DECEMBER

(Floral Display House)

Poinsettias, Stevias.

NOTES

Mr. G. H. Pring, Superintendent of the Garden, has been elected an honorary member of Pi Alpha Xi, an horticultural fraternity.

Mr. G. H. Pring has been appointed a member of the committee on School Gardens of the Society of American Florists and Ornamental Horticulturists.

Dr. E. S. Reynolds, Physiologist to the Garden, spoke on "Disease Resistance in Plants" at the Phi Sigma meeting held at the Garden, January 16.

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Botany Club of Soldan High School, January 9, on "How Plants Germinate."

Dr. George T. Moore, Director of the Garden, spoke before the Artists' Guild, January 19, on "Morality in Plants."

Mr. Paul A. Kohl, Floriculturist to the Garden, spoke before the Garden Club of St. Louis, February 12, on "Flowers for the Cool Conservatory."

Mr. G. H. Pring attended the meetings of the Illinois State Florists' Association during the Sixth Annual Florists' Week at the University of Illinois, January 28-31, and gave an illustrated lecture at the evening session, January 28, on "Orchids and Orchid Collecting."

Mr. Albert C. Burrage, president of the Massachusetts Horticultural Society and of the American Orchid Society, spent the afternoon of January 4 inspecting the orchid collection at the Garden Extension, Gray Summit. Mr. Burrage possesses one of the most important private collections of orchids in the country.

Among those visiting the Garden recently were Prof. A. T. Erwin, associate professor of horticulture, Iowa Agricultural College; Mr. A. Saeger, teacher of botany, Kansas City Junior College; Mrs. Aileen Erlanson, of the University of Michigan; Dr. Albert Brachet, director l'Institut d'Anatomie, Brussels, Belgium; Prof. J. T. Bucholtz, professor of botany, University of Texas; Dr. H. C. Diehl, associate physiologist, U. S. Department of Agriculture, Horticultural Field Laboratory, Wenatchee, Washington.

Mr. G. H. Pring has given the following talks recently: January 15, before the Webster Groves Home Garden Club, at the Westborough Country Club, on "Evergreens Suitable to Our Variable Climate"; January 22, before the Highland Woman's Club, Highland, Illinois, on "Collecting Orchids"; February 11, before the Women's Advertising Club, on "Orchids."

The meeting on the first anniversary of the founding of the St. Louis Horticultural Society, January 4, was a memorial to Henry Shaw. Mr. E. H. Angert, president of the society, opened the meeting with an address on Mr. Shaw and his in-

fluence on horticulture in St. Louis. Dr. George T. Moore gave a talk on the Garden and introduced the speakers, all of whom are members of the Garden staff. Mrs. Elinor Alberts Linder, Orchidologist, spoke on "Orchids"; Dr. Edgar Anderson, Geneticist, on "Courses in Gardening"; Mr. G. H. Pring, Superintendent, on "Orchid Collecting"; Mr. Paul A. Kohl, Floriculturist, "The Flower Shows at the Garden"; and Mr. L. P. Jensen, Arboriculturist, "The Gray Summit Extension."

The Members' Monthly Bulletin of the California Botanic Garden, Los Angeles, contains the following note regarding the trees planted in the Forest of Fame at the California Garden:

> **"The most distinguished tree of the month came as a gift from the director of the Missouri Botanical Garden. It is a direct descendant of the Daniel Boone Judgment Tree, which is still growing at Femme Osage, Missouri, Boone's old home.**
>
> **"The Missouri Botanical Garden obtained seed from this valued tree, now sixty-five feet tall, and produced some splendid seedlings one of which was sent here."**

A later Bulletin stated:

> **"Planting of the Daniel Boone Judgment Tree in the Forest of Fame by John Boone, great-grandson of the famous frontiersman, was an interesting ceremony of the month. Mr. Boone in the deerskin costume and coonskin cap of his ancestor made a colorful figure as he placed the tree, assisted by two great-great-grandsons who are residents of this city."**

STATISTICAL INFORMATION FOR JANUARY, 1929

GARDEN ATTENDANCE:

Total number of visitors	6,269

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	56
Total number of books and pamphlets donated	285

PLANT ACCESSIONS:

Total number of seed packets donated or received in exchange	10
Total number of plants donated	22

PLANT DISTRIBUTION:

Total number of plants distributed in exchange	1

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Director

KATHERINE H. LEIGH,
Assistant to the Director

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Pathologist

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MISSOURI BOTANICAL GARDEN BULLETIN

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VIEW IN THE HERBST GARDEN

Missouri Botanical Garden Bulletin

Vol. XVII MARCH, 1929 No. 3

NOTABLE ST. LOUIS GARDENS

IV. The Garden of Mr. John Herbst

With its clipped cedars, its flagstone paths and its stone-bordered flowerbeds, the Herbst garden has a very European air. It is altogether much more like a cottage garden in Devonshire than an ordinary American garden. Like the English gardens which it resembles, it has grown slowly. For most of his life Mr. Herbst has been a farm laborer in St. Louis County. In his spare time he built himself a home near the Bauer Road west of Tesson Ferry. With his own hands he made a clearing on the wooded hillside and built his three-room house. That finished, he set about to brighten up the clearing with flowers and shrubs and for some thirty years he has kept at it.

The site was not a promising one for a garden. The hillside was steep and rocky. The soil was thin and if one did succeed in getting enough together for a flower bed it was all washed down the hillside with the first hard rain. It might have been a good place for a rock garden, but who in St. Louis county was thinking of rock gardens thirty years ago? But Mr. Herbst was not discouraged. Remembering the gardens he had known as a boy, back in the old country, he set out to make one like them, as best he could under Missouri conditions.

He made the rocks themselves solve the problem of good soil. With them he walled in his flower beds; a low wall on the uphill side, a high one on the downhill side, so that the beds were level. Then with his basket he went into the woods and brought back load after load of leaf mould and loam until the beds were filled. The resulting soil is excellent for flowers. It is dark and rich and is in splendid tilth. Raising the flower beds has been helpful in more ways than one. The soil is well drained. The flowers are up where one can see them; even the snowdrops make a good showing when they blossom in the early spring.

Another feature of the Herbst garden which is more reminiscent of Europe than of America is the use of clipped evergreens. In Europe there are a number of native evergreens that take readily to clipping, and clipped evergreens, or "topiary work" as they are often called, are common features of European gardens. In St. Louis county the only native evergreen is the red cedar and it does not take kindly to the pruning shears. But by pruning carefully and often, and by keeping it up for thirty years, Mr. Herbst has been able to make his wild red cedars take on the conventional shapes so dear to the heart of the European gardener. All of his specimens are not equally successful but the best of them are nearly as smooth and thick as a clipped yew.

The garden is built on no formal plan. Most of the beds are roughly circular and between them flagstone paths ramble up and down the hillside. A longer path, with rough, stone steps, leads down to the brook, where, in the open sunlight, there is a garden for early vegetables. The cedars are set here and there without any apparent order, except a long row along the side of the cottage. There is a vine-covered arbor before the house and an outdoor dining room, mainly for the use of friends who come out from the city in the summertime. There is no real plan and yet all these diverse elements seem to fit together and the general effect is orderly and beautiful.

During the spring and summer the whole clearing is bright

CLIPPED RED CEDARS IN THE HERBST GARDEN

Flowers inconspicuous, spike-shaped,
leaves grass-like.....MOUSETAIL (Myosurus minimus)

Flowers inconspicuous; in open
clusters on slender stalks.....ANDROSACE (Androsace occidentalis)

Petals 5, separate from each other,
flower pansy-shaped.....JOHNNY-JUMP-UP (Viola Rafinesquii)

Petals 5, separate from each other,
petals veined with pink.....SPRINGBEAUTY (Claytonia virginica)

Petals united into a tube at the
base: leaves very small,
flowers usually blue.....QUAKER LADIES (Houstonia minima)
or
(Houstonia patens)

Petals 4, separate from each other,
flower stem rising from a ro-
sette cluster of leaves.....Several species belonging
to the Mustard Family

Seed pod deeply notched,
triangular.....SHEPHERDS PURSE (Capsella Bursa-
pastoris)

Seed pod slightly notched,
circular.....PEPPERGRASS (Lepidium virginicum)

Seed pod longer than broad.....Whitlow Grass
(3 species)

with flowers. First come the spring-flowering bulbs, snowdrops, and daffodils and grape hyacinths and tulips. Planted in among these old-fashioned garden flowers are native species, such things as Mertensias and dogtooth violets. There are whole beds given over to columbines: the red and yellow wild species, the old-fashioned double-flowering varieties in lavender and blue, the newer longspurred hybrids. After these are through flowering there are several kinds of lilies, of which Mr. Herbst has a very large number, since his original stock had multiplied many times in the rich and well-drained sandy loam.

Mr. Herbst will tell you that his garden is not what it should be. He has not been well these last few years and his garden has been neglected, the flowerbeds have not had the attention they needed and the cedars have not been clipped. Even so, the garden still looks neat and cared-for. Above all, it shows what can be done, under trying conditions, by one who has very little to work with except patience and a real love for flowers.

EARLY SPRING FLOWERS
OF
MISSOURI PASTURELANDS

In early spring, when trees and shrubs are still bare, our Missouri pastures are brightened with wild flowers. Though they are mostly low-growing and small-flowered species, they occur in such numbers that they form sheets of bloom and sometimes color whole hillsides. If they came later in the year, they might escape general notice, but their earliness makes them doubly appreciated. So many inquiries have come to the Garden about them, that the following article

has been prepared to enable the interested amateur to recognize the commoner species.

They may well be considered as a group, for they are all found at the same time of year, and in more or less the same sort of places. Few of them, in fact, are ever found growing strictly by themselves. It is much more common for two or three of them to be growing together. Sometimes as many as six or seven species, all flowering at once, will be found within a radius of a few inches. Most of them are what botanists have termed "winter annuals." That is, they are plants which start from seed in the fall and live over the winter as young seedlings, flower in the early spring, and then go to seed. After the seeds have ripened the parent plants die and only the seeds remain during the hot months of the summer. They then germinate with the fall rains, and the cycle is completed.

The following list does not pretend to be absolutely complete. Some of the later flowering species, such as buttercups or daisies, may blossom rather ahead of time. In pastures recently developed from woodlots, or in pastures next to existing woods, a number of characteristic woodland species may be found, such as mayapple or adderstongue. Dandelions and some species of violets will be found in many pastures. By and large, however, the bulk of the early spring flowers growing on pasturelands in Missouri will be found to belong to one of the following species. The chart in Plate 12 represents the outstanding differences between the various species and in the following pages each one is taken up at greater length.

Mousetail *(Myosurus minimus)*

We may begin somewhat illogically by disposing of two species whose flowers are so inconspicuous that they are generally overlooked. In fact many people might not even consider them as flowers at all. Mousetail, whose flower actually looks like a small green mouse tail on a stalk, is

really a sort of buttercup. Its five little petals, narrow and greenish, can be found at the base of the "tail" and are not so different from the petals of some species of buttercups. The tail is the seedbearing portion of the flower, technically

FIG. 1. MOUSETAIL, MYOSURUS MINIMUS. x2.

known as the receptacle. Buttercups, too, have receptacles, but they know their place and remain modestly withdrawn in the heart of the flower until after the petals have fallen. In the mousetail, however, the seed-covered receptacle makes up practically the entire flower. It is a blunt spike, thickly set with small green seeds, and looks rather like a small plantain gone to seed. Careful examination will reveal the little stamens, the greenish petals, and the spurred sepals, all clustered about the base of the "tail." The leaves are even less conspicuous. They are long and narrow and almost grass-like. The whole species might be said to have "gone to grass" for it is only a few inches high and resembles a little tuft of grass.

Mousetail is fairly common in Missouri and is found here and there on bare spots in pastures or in deserted fields, throughout our area. It has a preference for sandy pastures where the soil is thin; on richer soil it is choked out by the grass. In a few places, as on Buck Knob above Crystal City, it occurs in large numbers.

Androsace *(Androsace occidentalis)*

Androsace (pronounced an-drahs'-uh-key) resembles mousetail in having inconspicuous flowers and in preferring sandy soil. It is found in sandy pastures, particularly those that have developed from old fields. It grows in large numbers on the dumps in East St. Louis and, like mousetail, covers large areas on Buck Knob near Crystal City.

The flower of Androsace has a white corolla but it remains hidden within the green calyx, and the whole flower is very small. The flowers are borne in open clusters on flower stalks which are from an inch to six inches high. Around the base of the flower cluster are several smooth, bright green leaves, technically termed the involucre. The flower stalks themselves spring from a tight basal rosette of similar leaves which are a size or two larger. The two sets of clustered leaves, the large basal ones, and the smaller ones of the involucre, give the plant an odd, two-storied appearance.

While Androsace could hardly be called beautiful it is a clean and bright-looking little plant as Figure 2 shows. It has graceful proportions and its odd little flower clusters are certainly not unattractive. Our species might be thought of

FIG. 2. ANDROSACE OCCIDENTALIS. x1½.

as a sort of poor relation for there are alpine species of Androsace, both in Europe and in western North America, which have very attractive flowers.

Johnny-Jump-Up *(Viola Rafinesquii)*

While the flowers of the Johnny-jump-up are bright and attractive, it, too, can be spoken of as a poor relation. It is, as a matter of fact, closely akin to our garden pansies and to the beautiful alpine species of Viola from which the cultivated pansies were developed. The similarity to pansies is shown throughout the whole plant. It could effectively be described as a much smaller, much scrawnier, much less brightly colored pansy. Several of the common names, such as "wild pansy" or "heartsease" which have been given the species, recognize this relationship.

The flowers are small, seldom over half an inch in diameter, and their predominating colors are bluish white and cream yellow. Usually the upper two petals are a bright bluish white, while the lower petals are a creamy yellow. As in many of our cultivated pansies, there are tiny black lines on the lower petals.

The comparison with the cultivated pansy should not cause confusion with another species of Viola, *V. pedata*, the bird-foot violet, which in Missouri is often referred to as "wild pansy." As a matter of fact, *Viola pedata* is not at all closely related to the true pansies. They have a branching stem from which arise both leaves and flowers. It has no true stem and its leaves are peculiarly cut and divided until they are almost fernlike in outline. Furthermore its flower is not shaped like a pansy. Pansies have petals that curve inward; those of *Viola pedata* are flat or may even curve backward and outward. In only one respect is it pansy-like. The upper two petals of the flowers are a beautiful dark purple and are thick and velvety.

Viola Rafinesquii is a very common species in Missouri. It grows in pastures, at the edges of fields, along roadsides, on the cinder banks of railroad tracks, in open woods on limestone hills. It is beautiful enough to merit cultivation but it is no easy matter to establish it in one's garden. As has

already been explained, it is a winter annual. At the end of the flowering season the plant will die and unless there are seeds on the plant, and unless those seeds sprout in the fall and find a place to their liking, there will be no blossoms the following spring.

Quaker Ladies *(Houstonia minima and Houstonia patens)*

Quaker ladies are among our commonest wild flowers. So common are they that they have received many different popular names. In Missouri, where real forget-me-nots do not grow wild, they are often known by that name. Other names commonly given them in this part of the country are "Innocence," "Bluets," "Baby-blue-eyes," and "Churn-dashers." The two species considered here are very closely related. They are distinguished mainly by slight differences in the proportions of their flowers and in the size and shape

FIG. 3. QUAKER LADIES.
HOUSTONIA MINIMA. x1½.

of their seed pods. In *H. patens* the tube of the flower is proportionately longer and the calyx lobes are smaller, than in *H. minima*. This latter species is the one most commonly found in the vicinity of St. Louis, though *H. patens* is well-established at several points.

The flowers are small, they are seldom more than a quarter of an inch in diameter, but even at that they dwarf the rest of the plant. The stems are short, with tiny, opposite leaves, and the flowers seem almost to spring directly from the ground. They are usually a dark blue, which fades slightly in the sunlight, but there are occasional individuals which are pure white. In many pastures the flowers occur in enormous numbers, forming great sheets of mingled blue and white that may even mantle a whole hillside. Seen close at hand, the flower is well-proportioned. The petals are united below into a cylindrical tube, which flares out above into four, pointed lobes.

There are other species of Houstonia native to Missouri but they are seldom or never met with in pastures. *Houstonia caerulea*, the common bluet of New England pastures, occurs in Missouri, but here it usually grows in partial shade. It can easily be distinguished from *H. patens* and *H. minima* for it is a very pale sky blue, and the throat of the tube is rimmed with yellow. The other species native to Missouri bloom in the late spring or early summer. While their flowers are similar to those of *H. minima* and *H. patens*, they are tall, much branched species with conspicuous leaves.

Spring Beauty *(Claytonia virginica)*

The spring beauty is another common and widely distributed species. It develops rapidly in the early spring for it has an underground bulb or tuber on which to draw for food. At the base of the stem there are two narrow leaves and from between them rises the flower stalk with its gracefully borne pink and white flowers. They are usually a bright rose pink, though occasional specimens will be found which are practically white. In either case the petals are attractively marked with narrow veins of a deeper pink.

The remaining species all belong to the Mustard Family, and have a number of points in common. Like the plant from which the family takes its name, all of the species have a pungent juice. Their flowering stems spring from a basal rosette of leaves and the stems blossom from below, upwards. That is, the lowest flower on the stalk is the first to bloom, then the second lowest opens, and so on in regular succession. The stalk meanwhile continues to develop at the upper end, so that a single stalk often has buds at the tip, flowers in the middle, and ripened seed pods at the base. The flowers of all the species described below are small and are composed of four white petals, which are separate from each other. The petals are very narrow at their bases and flare out widely above, so that botanists usually speak of them as composed of a blade (the wide part) and a claw (the narrow part).

Shepherds Purse *(Capsella Bursa-pastoris)*

Shepherds purse is hard to describe because it changes so as it develops. In early spring it shows only one or two tiny, star-like flowers which barely rise above a rosette of small, fern-like leaves. By the end of the season it is a husky weed which may be even two or three feet in height, with a long flower stalk on which are many seed-pods in all stages of development. The seed-pods, however, are unmistakable and a few, at least, will be found on all but the very youngest specimens. They are roughly triangular in outline and have a broad deep notch at the apex. It is they which give the plant its common name, for they are the same shape as the leather purses which shepherds of ancient times carried on their belts.

Shepherds purse is seldom found in large numbers in pastures and more commonly occurs as isolated individuals here and there at points where the soil is thin.

Peppergrass *(Lepidium virginicum)*

Peppergrass shows many similarities to shepherds purse, to which it is closely related. Like that species its aspect changes greatly as the plant develops. The two species differ in sev-

eral respects. The leaves of peppergrass are usually much less finely cut and the plant is generally stockier. The seed pods are the easiest way of distinguishing the two species. Those of peppergrass are roughly circular in outline, with a small notch at the tip. The flowers are furthermore set closer to the flowering stalk, are closer together, and are more regularly spaced on the stalk.

Peppergrass gets its name from its peppery juice. It has a not unpleasant taste and is often gathered and fed to canaries and other cage birds. The green seed pods are sometimes put in salads or used as a sandwich filling. It occurs in practically the same situations as shepherds purse and the two are often found growing together.

FIG 4.
WHITLOW GRASS, DRABA BRACHYCARPA. x1.

Whitlow Grass (*Draba verna, Draba brachycarpa, and Draba caroliniana*)

When present, whitlow grasses are usually found in very large numbers. At a little distance they often give the appearance of meal or lime having been sprinkled over the turf. This is particularly true of the earliest species, *Draba verna,* which is the rarest species as far as Missouri is concerned. It is a European species but has found its way over to this country and is very commonly met with in the eastern states. In Missouri it is known only from Jefferson Barracks where it is found in the Military Cemetery. There it practically carpets the ground and in early spring the cemetery looks as if a fine white meal had been sprinkled irregularly over the graves and paths. It differs from our native species in its smaller size and in having no leaves whatever on the flower stalks.

Our two native species are most easily told apart by their seed pods and this difference has been illustrated on the chart in Figure 1. *Draba brachycarpa* (the name means "short pod") is by far the commonest species and is probably the commonest wild flower of all those discussed in this article. It occurs everywhere, in old fields and in pastures, and persists for years in city parks and suburban lawns. It is very commonly found growing with quaker ladies and the mingled blue and white flowers often make an almost solid carpet of bloom. *D. caroliniana* is a taller and more graceful species and is less commonly met with though it is by no means rare. Another species of Draba, *D. cuneifolia,* is also found in Missouri. It does not occur in pastures but is found in limestone glades in the Ozarks.

NOTES

The January-February number of "Parks and Recreation" contains an article by Mr. L. P. Jensen, Arboriculturist, on "Pruning of Ornamental Shrubs".

Mr. G. H. Pring, Superintendent of the Garden, spoke before the Cemetery Superintendents on March 14 on "Spring Work in the Garden".

The January, 1929, number of the "Bulletin of the American Iris Society" contains pictures of the Iris test garden at the Missouri Botanical Garden, with a brief account of this garden.

The March number of the "Ladies Home Journal" contains an article on "Water Lilies" by Mr. G. H. Pring. It has colored illustrations of many of the varieties developed at the Garden.

Among those visiting the Garden recently were Dr. P. B. Hussey, Professor of Biology, Louisiana State Teachers' College; Mr. Karel Hujer of Prague; Mr. Yukio Yamada, who consulted the herbarium.

Dr. George T. Moore, Director of the Garden, spoke before the Scottish Rite Club on February 26 on "The Plant Commonwealth". On March 8 he spoke before the pupils of Cleveland High School on "What goes on inside the plant". On February 18 he spoke before the Kirkwood Garden Club on "Some activities of the Missouri Botanical Garden".

The March number of the "Flower Grower" contains the first installment of a reprint of Mr. Kohl's article on Seedlings which appeared in the Garden Bulletin for February, 1928. The plates illustrating his article were likewise used in the March number of the "The American Home" to accompany an article on "An indoor start with seeds". This entire Bulletin has been reprinted by several seedsmen in this country and distributed to their customers.

STATISTICAL INFORMATION FOR FEBRUARY, 1929

GARDEN ATTENDANCE:

Total number of visitors.....19,740

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 82
Total number of books and pamphlets donated..... 45

PLANT ACCESSIONS:

Total number of plants and seeds donated..... 400

HERBARIUM ACCESSIONS:

JANUARY, 1929

By Purchase—

Arnold Arboretum, Harvard University—Plants of eastern United States, collected by E. J. Palmer..... 835
Weigel, Th. Oswald—Weese's "Eumycetes selecti exsiccati" Fasc. I-XIV, Nos. 1-350, inclusive..... 350
Weigel, Th. Oswald—Degen's "Cyperaceae, Juncaceae, Typhaceae et Sparganiaceae Hungariae Exsiccatae," Fasc. V (tome V), Nos. 201-280..... 80

By Gift—

Graves, E. W.—Ferns of Iowa..... 2
Spaulding, Perley—*Dasyscypha Willkommii* from Massachusetts 1
Woodson, R. E., Jr.—*Apocynum spp.* from north central United States 8

By Exchange—

Botanical Institute, Masaryk University of Bruno by Dr. Jn. Podpera—Plants of Czechoslovac Republic..... 100
Grant, J. M.—Plants of Washington..... 100
House, Dr. H. D.—Plants of New York..... 72

By Field Work—

Kellogg, John H.—Plants of Missouri..... 56

Total 1,604

FEBRUARY, 1929

By Purchase—

Herter, Dr. Guillermo—Plants of Uruguay..... 172
Steinbach, J.—Plants of Bolivia..... 300

By Gift—

Anderson, Dr. E.—Plants of North Carolina and Tennessee	23
Deam, C. C.—Plants of Indiana	2
Gould, Miss Lois—Plant of Wyoming	1
Johnston, Earl Lynd—Plants of Colorado	115
Mathias, Miss Mildred—Plants of Missouri	2
Nyi, T. K.—Plants of China	51
Pickering, A. C.—Plants of Horticulture	11
Pring, George H.—*Phalaenopsis Reinstadiana* from Horticulture	1
Thompson, Prof. J. W.—Plants of Washington	42

By Exchange—

Cornell University, by Prof. K. M. Wiegand—Plants of New York	197
Field Museum of Natural History—Miscellaneous duplicates	555

By Field Work—

Kellogg, John H.—Plants of Missouri	157
Total	1,629

Floral Displays of Special Interest in 1929

In order that readers of the Bulletin may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

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FLOWERING SPECIMEN OF BRODIAEA VOLUBILIS.

Missouri Botanical Garden Bulletin

Vol. XVII APRIL, 1929 No. 4

BRODIAEA VOLUBILIS, THE SNAKE LILY.

An interesting western wildflower, the "Snake Lily" or "Twining Hyacinth" of California, has recently been in bloom at the Garden and is illustrated in Plate 13. Though it was discovered in the Sacramento mountains as early as 1846 and was shortly afterwards introduced into cultivation, it is seldom seen in this part of the country.

The bulbs shown in the illustration were obtained from a California firm and were planted in October. They were kept in a dark, cool cellar until root growth was well started and were then transferred to a cool greenhouse. Otherwise they received no special care. The leaves, which had dried up by the time the picture was taken, appeared in a few weeks and when they were well developed a short-stemmed flower bud was seen at their base. Slowly at first, and then with increasing rapidity, the stem began to elongate, twining and twisting about in its effort to find a support. It dived under flower pots, twined about other plants in the greenhouse bench, and then wound its way up a wooden stake which had been placed to protect it. Other stems soon appeared to complicate the tangle, which unfortunately had to be somewhat unravelled before the plant could be removed from the greenhouse to have its picture taken. It is this curious habit which has given rise to the common name of snake lily, a name which is made even more appropriate by the appearance of the young flower bud. Until almost the time of flowering the separate buds are protected by a green spathe, which is tightly wrapped about

the whole cluster, giving it very nearly the shape of a serpent's head.

In the California foothills, where the species is native, these snakelike stems sometimes reach a length of twelve feet and grow at the rate of several inches a day. Toward the end of their mad career they often die off at the base so that by flowering time the bright pink blossoms are no longer connected with the mother plants. Country children, noting that the flowers grew quite as well when detached from the parent bulb, have learned to carry the long stems indoors and hang them on lace curtains in sunny windows. There they continue to loop about through the large meshes of the lace until their growing days are past and they burst into flower.

STUDY TOPICS FOR A GARDEN VISIT.

Recent years have seen a marked increase in the use of the Garden by high school classes in Botany and General Science. This is particularly true of schools outside the Saint Louis area. With the development of motor transportation it is now possible for a teacher to bring a class on an excursion of several hundred miles at a moderate expense.

The following list of topics was prepared at the request of a teacher whose high school class will visit the Garden this month. It is published to call the attention of schools and garden clubs to the educational possibilities of the Garden and to suggest the sort of subjects which may profitably be studied on such a trip. While it was prepared for use during April, it could easily be adapted for other times of year. In the fall, for instance, the Thistle family (Compositae) could be substituted for the Rosaceae in topic number four. For each topic, the location of the material to be studied is indicated in brackets.

1. A comparison of Zelkova and American Elm. Compare the bark, branches, leaves, etc. Zelkova is an eastern genus of trees, closely related to our elms. (A specimen of Zelkova will be found a little to the north of the main entrance.)

2. Common plants of medicinal value. (Medicinal garden.)

3. A study of desert plants. Notice particularly the different kinds of thorns, spines, etc. (Cactus House.)

4. A comparison of different members of the Rose family (Rosaceae), particularly as to flowers and fruit. (Rose garden, knolls.)

5. A study of the Ginko tree. Study its bark, leaves, habit of growth, twig formation. Compare the shapes of the ginkos in different parts of the Garden. (Main entrance, knolls.)

6. Plant Odors. (Economic house, medicinal garden, economic garden.)

7. Find as many differences as possible between the leaves of Cycads and those of Palms. (Cycad House, Palm House.)

8. Locate the largest leaves you can find in the Garden. Study the manner in which they are supported. What do you think of their construction from a mechanical standpoint? (Entire Garden.)

9. Compare the dates of flowering for trees and flowers studied in your home town and in the Garden. (Entire Garden.)

10. A study of Oaks. Compare the leaf shapes and the bark on the young branches for as many species as possible. (Mausoleum grove.)

11. A study of garden varieties of Iris. Compare the color, color pattern, size of flower, arrangement of flowers, etc., for as many varieties as possible. Which ones do you prefer and why? (Linnaean garden, American Iris Society test garden.)

12. A comparison of the species of Aesculus. Compare particularly the Horse Chestnut *(Aesculus Hippocastanum)* and the Buckeye *(Aesculus octandra)*. Note differences in leaves, flowers, leaf scars, numbers of leaflets, color of young bark, etc. (Mausoleum grove, knolls.)

13. The layout of the Missouri Botanical Garden, from the standpoint of Landscape Architecture. Note particularly the

radiating vistas from the center of the Rose Garden; the combination of Main greenhouses, Italian garden, and pergola; the concealment of the lily pools from the Rose garden. (Entire garden.)

14. A study of Palm stems. For as many species as possible examine the mature stem or trunk, noting what happens to the bases of the fallen leaves in each case. (Palm house.)

15. Plants of everyday use. Study the plants and labels in the Economic house and describe those plants whose products are used in your home. (Economic house.)

16. Geography. Find the plants native of the country most recently studied and contrast them with those of your local flora. Australia, India, Africa, Mexico, etc. (All greenhouses.)

SPECIES AND VARIETIES OF PHLOX FOR MISSOURI GARDENS.

Phloxes have long been favorites in the gardens of Europe, no English cottage garden is complete without a few specimens, but in common with many other North American plants they have been neglected in their native home. Yet they are easily cultivated, they blossom over a long flowering period, and they are available in many different colors. By careful selection of species and varieties a cycle of bloom may be had from early April until well into the fall. They vary in height from low-growing, mat-like species such as *Phlox subulata* to tall growing forms like the garden varieties of *Phlox paniculata*, which often reach a height of four feet or more. In the following account no attempt has been made to discuss all the species of phlox, or even all those of garden value, but attention is merely called to the commoner species that have proved easy to grow and to flower in mid-western gardens.

Phlox paniculata.

To this species, and its hybrids, belong the common varieties of our gardens, usually referred to as "Hardy Phlox". It is a stout, erect perennial, surviving our hardest winters and

giving a good show of bloom in all but the driest summers. In height it ranges from two to four feet; occasional well grown specimens may be even taller. The flowers are borne in compact panicles on leafy stems, producing at their best a mass of color that is rivalled by very few other garden subjects. They come in shades of red, pink, rose and lavender to white, and bloom from July to September.

The species from which these garden varieties were derived is native to North America and is found in woods and thickets from Pennsylvania to Florida, west to Illinois and Louisiana. It is, as a matter of fact, found in a few places in the vicinity of Saint Louis. Most of the varieties found in gardens are probably hybrids with an earlier flowering American species, *Phlox maculata.*

The varieties of Hardy Phlox are well adapted to the perennial border where, if given the proper care, they will flourish and spread into large clumps that will make a fine showing. They should be planted two to three feet apart. A well-developed plant will throw up a large number of stems each year, but to insure perfect spikes, half of them should be thinned out. The flowers should be removed as soon as they fade and in good seasons this will result in a second flowering period. During hot, dry weather the plants should be watered frequently and a light mulch is also beneficial.

Phlox Drummondi, Annual Phlox.

Unlike the other species considered in this article, this phlox is an annual and blossoms the same year that it is planted. It is of upright growth and branches freely, growing from six to eighteen inches tall. The flowers range in color from white, pale cream, through pink and lavender to deep red and purple.

Phlox Drummondi is a native American species and is found wild in Texas where it grows in sandy soils. In recent years it has been greatly improved, both in size and color. The improved strain is known as *Phlox Drummondi grandiflora.*

It is not one of those fleeting annuals which produce a flush of flowers and are soon gone. If the faded flower heads are

removed, the plants will continue to blossom until well into the autumn.

Fig. 5. PHLOX DIVARICATA, WILD SWEET WILLIAM.

Phlox subulata, Moss Pink.

The moss pink is quite different in aspect from the species described above. As its name would indicate, it is a low growing, almost moss-like species, which forms solid carpets of bloom in the early spring. It has run wild extensively in many parts of the country and is often found on old walls or in deserted graveyards. On a number of estates in Saint Louis county it has been used as a bank cover between the fence line and the road, with very pleasing results.

The flowers are borne flush with the tufted leaves and are so plentiful that when the plant is in full bloom it forms a solid sheet of color. The commoner varieties are pink or magenta, though lavender and white-flowered varieties are occasionally seen.

The moss pink is an excellent subject for rock gardens, dry terrace banks, and hillsides. It will flower in almost any soil that is not too wet, or too deeply shaded.

Phlox bifida, Cleft Phlox.

The three remaining species are shade-loving forms, suitable for the wild garden, or a semi-shaded situation in the perennial border.

Phlox bifida is of a diffuse habit of growth. The main stem is prostrate and tends to persist from year to year. It sends up erect ascending branches, three to six inches high, which are in April and May so abundantly laden with flowers that the foliage is concealed and the ground covered with a graceful carpet of bloom. The flowers are pale purple or white, and, as the name would indicate, have deeply notched corolla lobes, giving the plant an airy and graceful appearance.

Phlox divaricata. Blue Phlox, Wild Sweet William.

Phlox divaricata, and the closely related, *Phlox pilosa*, are two of our commonest, as well as loveliest, wild flowers. *P. divaricata* prefers richer, moister soils than *P. pilosa*, and for that reason is more commonly met with in low woodlands, while the latter species is found on the higher slopes.

As Figure 5 shows, *Phlox divaricata* is a slender species, seldom more than a foot and a half in height. The individual

flowers are large for the genus, are usually blue, and are borne in showy clusters of from ten to thirty blossoms. It is a shade-loving species and will establish itself in the average wild garden with very little encouragement. It will sometimes do well in the perennial border, particularly if the situation is not too sunny. It blossoms at the same time as the Darwin tulips and in one garden in Webster Groves it has been used effectively with the Darwin tulip, Clara Butt. Its low masses of gray-blue flowers form a pleasing contrast to the bright pink of the tulips.

Phlox pilosa, Downy Phlox.

The downy phlox is most easily distinguished by its color, which is usually some shade of magenta, or there is at least a magenta "eye" in the middle of the flower. It is furthermore differentiated from *P. divaricata* by its hairier stems and leaves, its slightly later blooming season, and its preference for drier and more acid soils. On sandy prairies and along railroad tracks it sometimes grows in great masses and fully justifies the name phlox, which comes from the greek word, Φλοξ—meaning a flame. Like the two preceding species, the downy phlox is to be recommended for wild gardens.

CULTURE AND PROPAGATION OF HARDY PHLOX.

The garden varieties of Phlox will grow in almost any kind of soil but do their best in a soil that has been previously enriched with well decayed barnyard manure. They will not refuse to bloom in a less fertile soil, but will have smaller and fewer flower heads.

All old stems should be left undisturbed until they have died down and should then be cut off about two inches from the ground. The plants will not require much winter covering unless they are in a weakened condition, in which cases a good covering of rotted manure or leaf mold is essential. This will improve the plants as much as taking them up and planting in fresh soil. Vigorous plants make a large mass of roots that soon exhaust the soil around them. They should be lifted, divided, and reset in soil that has been well spaded and fertilized with composted manure.

Propagation is by seeds, cuttings, and by division of the

roots, the latter being the simplest and most usual method. Division of the clumps is usually accomplished in the fall. The plants are lifted and cut into several smaller plants with a sharp knife and are then reset. After the ground is frozen they should be given a mulch of well composted manure and leaf mold.

New and choice varieties may be increased still more rapidly by making cuttings in the early spring. When the young shoots are about one and one-half or two inches long, they should be cut from the parent plant, leaving a "heel" or small piece of the rootstalk, on each cutting. They are then placed in a flat of sand, or sandy soil, in a house or hotbed with a temperature of around 65 or 70 degrees. Cuttings made in this way should develop into thrifty little flowering plants the first season.

Hardy phloxes can be grown from seed, but since the named varieties do not come true from seed, this method is used only by those who are trying to originate new varieties. The seed may be planted either in the late summer shortly after it is ripe, or in the early spring.

NOTES

Mr. Paul A. Kohl, Floriculturist to the Garden, spoke before the Garden Club at Springfield, Illinois, on March 28th, on "Plant Propagation".

On April 2nd, Mr. George H. Pring, Superintendent, gave an illustrated lecture on "Orchids", before the Junior Council of Alton, Illinois. During the National Flower Show at Buffalo, N. Y., he was chairman of jurors in the tropical plant section.

The exhibit "Orchids from Seed to Flower," showing the work being carried on at the Garden by Mrs. Elinor Alberts Linder, Orchidologist, was awarded a Large Gold Medal at the Centennial Exhibition of the Massachusetts Horticultural Society at Boston. The same exhibit was shown at the National Flower Show at Buffalo, April 6-14, where it received another gold medal.

STATISTICAL INFORMATION FOR MARCH, 1929

GARDEN ATTENDANCE:

Total number of visitors	46,558

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	44
Total number of books and pamphlets donated	64

PLANT ACCESSIONS:

Total number of plants and seeds donated	393
Total number of plants and seeds bought	21

HERBARIUM ACCESSIONS:

By Purchase—	
Holzinger, J. M.—"Musci Acrocarpi Boreali-Americani et Europaei," Fasc. XXVII, Nos. 651-671, inclusive	21
Migula, W.—Cryptogamae Germaniae, Austriae et Helvetiae exsiccatae, Fasc. 46-49	100
Pittier, Prof. H.—Plants of Venezuela	160
By Gift—	
Beecroft, W. I.—*Agave sp.* from Nevada	1
Bruner, W. E.—*Condalia obtusifolia Weberb.* from Oklahoma	1
Featherly, Prof. H. I.—Plants of Oklahoma	3
Hume, H. Harold—Plant of Horticulture	1
Martin, Dr. G. W.—Fungus from Iowa	1
Mathias, Miss Mildred—Plants of Missouri	15
Shope, Paul F.—Fungi from Colorado	2
By Exchange—	
Demaree, Prof. D.—Plants of Arkansas	300
St. John, Prof. Harold—*Apocynum pumilum* (Gray) Greene from Washington	1
U. S. National Museum by Dr. Wm. R. Maxon—Miscellaneous herbarium duplicates	223
Total	829

Floral Displays of Special Interest in 1929

In order that readers of the Bulletin may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

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Missouri Botanical Garden Bulletin

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GARDENING AND ITS RELATION TO OCCUPATIONAL THERAPY

For the last two years a course in elementary horticulture has been given at the Garden to a class of young women from the School for Occupational Therapy. These young women are preparing themselves for positions as occupational therapists in hospitals, public institutions, and private homes. They are studying gardening in order that they may be able to direct their future patients in such activities as growing vegetable and flower gardens, operating small greenhouses, and brightening hospital sun-porches and occupational therapy workshops with plants and flowers.

The five short articles which follow are by-products of the course. They are very largely abstracts of papers prepared by the students themselves, and are brought together in this way in order that the information contained may be more generally available.

GARDENING WITH THE HANDICAPPED HOMEBOUND

I. Types of patients—
  A. Mentally handicapped.
    1. Insane.
    2. Depressed.
    3. Hysteric.
    4. Dementia praecox.
  B. Physically handicapped.
    1. Handicapped who are up and walking.
      a. Epilepsy.
      b. Juvenile paresis.
      c. Cardiacs.
      d. Carcinoma.
      e. Blindness.
      f. Tabes dorsalis.
      g. Hemiplegia.
      h. Diabetes.

2. On crutches.
    a. Arthritis deformans.
    b. Amputation.
    c. Sclerosis.
    d. Osteo-myelitis.
    e. Fractures.
    f. Poliomyelitis.

3. Chair-bound.
    a. Paralysis.
    b. Arthritis.

4. Bed-ridden.
    a. Tuberculosis.
    b. Cardiacs.

II. Plants and flowers grown by patients—

A. Bulbs.
    1. Hyacinths.
    2. Tulips.
    3. Lilies-of-the-valley.
    4. Amaryllis.

B. Sponge gardens (resting in water).
    1. Large sponges dry up quickly; require much watering; last two months with care.
    2. Small sponges very satisfactory; last from four to six weeks.
    3. Seeds and cuttings planted.
        a. Red-top.
        b. Mustard.
        c. Sedums.
        d. Lentils.
        e. Bryophyllum.
        f. Ferns.

C. Cuttings—in water.
    1. Ivy.
    2. Bryophyllum.
    3. Philodendron (long shoots).
    4. Pussy-willows.
    5. Forsythia.
    6. Wandering Jew.
    7. Umbrella plant.

D. Plants in sand.
    1. Lentils.
    2. Sedums.
    3. Calendula.
    4. Red-top.
    5. Mustard.
    6. Bryophyllum.
    7. Grape-fruit seeds.

E. Plants in soil.

1. Mustard and water-cress grown in strawberry baskets on window sills; can be sold in bunches.
2. Rhubarb (roots for forcing); grow in the dark; cool temperature; ready for cutting in two weeks.
3. Sedums for commercial sale; potted in one-inch pots.
4. Pepper-grass for canaries.

The experiment of bringing gardening into the lives of the homebound has been tried in St. Louis, under the auspices of the Missouri Association for Occupational Therapy, by Miss Laura Nielsen, of the Home Service Department. In this particular department there are about forty patients undergoing treatment, including men, women, children; rich and poor; colored and white. All types of patients are handled in this service, those handicapped both mentally and physically. Insanity, depression, hysteria, and dementia praecox are some of the mental ailments; while physical ills are many and varied. The physically handicapped of this group studied may, for convenience, be grouped in four divisions: patients whose condition confines them to their homes but permits being up and around; those who are on crutches; thirdly, that group who are chair-bound; and last, patients who are bed-ridden. Those who have epilepsy, juvenile paresis, cardiac trouble, carcinoma, blindness, tabes dorsalis, hemiplegia, or diabetes fall in the first group of "up and around patients"; while on crutches we find patients suffering from arthritis deformans, amputation, sclerosis, osteo-myelitis, fractures, and poliomyelitis. The chair-bound patients consist of paralytic and arthritic cases; and the bed-ridden patients are of cardiac and tuberculous type.

To bring sunshine, cheer, and a new lease on life to the homebound has been the purpose of this experiment. Any one finding that he can actually create anything, whether it be flowers, engines, or a dress, derives a great deal of benefit from the creation. When a handicapped person particularly creates something, it does wonders toward restoring his confidence in himself, and the knowledge that he can successfully make one thing spurs him on to making or attempting more. In working with flowers he receives strength from the soil, and in

watching the progress of growth he feels a very definite participation in the raising of the seed, plant or bulb, whichever it may be. Arthur Stringer, in his poem entitled "There Is Strength in the Soil," says:

"There is strength in the soil,
In the earth there is laughter and youth.
There is solace and hope in the upturned loam.
And lo, I shall plant my soul in it here like a seed!
And forth it shall come to me as a flower of song;
For I know it is good to get back to the earth.
That is orderly, placid, all patient."

A patient may raise bulbs successfully provided they can be kept cool and dark during the primary stages. Hyacinths may be grown in water with stones, or in the soil; tulips, lilies-of-the-valley and amaryllis should be grown in soil.

Working with sponges forms an interesting project. Either large sponges, which are more difficult to procure, or small ones may be used. Before using them it is advisable to sterilize them to remove the foreign matter contained. After this is done seeds and cuttings planted in them do splendidly. The experiment has been made of suspending the sponges in a dish of water, but it was not a success, as the sponge dries out too quickly and it is too laborious to keep it moistened sufficiently to germinate seeds. The large sponges dry out more rapidly than the smaller ones and require much watering, even though they are resting in water, for the sponge does not absorb the water through the thickest part. Merely to watch the seeds of red-top, mustard, lentils, and cuttings of bryophyllum, sedums, and ferns thrive is great fun; but when the plants are grown in a sponge cut to resemble mountains, valleys, with a hole to represent a lake, plains, etc., then it is real sport to watch the trees grow on the mountain sides, the grain on the plains. To add even more atmosphere, toy animals and men in proportion may be used to give the effect of a miniature rural scene. Children adore making sponge gardens and watching them develop. It is a project which will keep the interest for some time, for the larger sponges will last two months or more, while the smaller ones will remain green from four to six weeks.

Cuttings sprouted in water are interesting to watch. Ivy, wandering Jew, long shoots of philodendron, and umbrella plants send out shoots quite readily. The bryophyllum leaf, put in a saucer of water by the bed-side of the patient, proves a constant source of interest when the new sprouts shoot out on all sides of the leaf. Pussy-willows and forsythia branches cut in bud will blossom within ten days indoors, and are cheerful to look at. After the pussies go by and the flowers on the forsythia go to seed, new shoots come forth which can be watched for weeks.

Sand may be used as a simple means of growing seedlings in the home. To eliminate the carrying of soil into the sick room, water and sand may be used, and sand is much cleaner to handle. Lentils, sedums, calendulas, red-top, mustard, bryophyllum, and grape-fruit seeds do well, and will grow from four to six inches in just a saucer of sand.

When a patient is able to walk about, some phases of gardening can be profitably carried on in the home. Mustard and water-cress can be grown in soil in strawberry baskets on window sills. Rhubarb, when roots for forcing are obtainable, can be easily raised. It will grow in light as well as dark, provided the proper amount of moisture and heat is given. It will grow in various temperatures from 50-70° F., but the stalks will be a bit more spindly if grown in a very warm room. The best results are obtained at a temperature of 55-60°. The raising entails little labor. Planting the roots in dirt and watering regularly is all the effort necessary. If the roots are planted early in the spring, the rhubarb, which matures in about three weeks, can be sold in bunches for fancy prices. Another successful home-garden product is Sedum. The plants may be easily rooted in sand, and later planted in one-inch pots. They grow slowly, and may be used for party favors, gifts to invalids, or such purposes.

Any of these commercial plants can be grown in the patients' own homes or rooms. They have the pleasure of watching them grow, and the knowledge that they are doing something which will bring a remunerative return does wonders for their mental attitude, for homebounds become very sensitive and develop an inferiority complex about their abil-

ity to compete with the world of normals. Working with soil and plants gives a return in renewed vigor and enthusiasm, which improves decidedly one's mental and physical condition.

This experiment would be considered a successful one if only measured by the aggregate number of hours of happiness and enjoyment derived from the growing of flowers and plants. However, happiness is not the only result of the experiment, for return of confidence is noticeable too, and that is vital to a depressed patient. If this return of confidence were the only result shown, it would more than pay for the expenditure of energy necessary to make this experiment.

FOLIAGE PLANTS AND BULBS

FOLIAGE PLANTS

Aspidistra.—Usual method of propagation by division. A root-bound plant if kept well-watered is better left undisturbed; may be left undisturbed several years. Fibrous loam with leaf soil and a little charcoal is a good potting soil. Frequent sponging of the leaves is necessary; milk and water for sponging produce glossy appearance.

Bryophyllum.—Propagation by cuttings or leaves. Very easily rooted.

Coleus.—Gives color to greenhouse. Cuttings made in fall make huge plants by June or July. Best method of propagation is by cuttings. Best temperature is 55-60° F.

Cyperus.—Propagation by cuttings. Easily grown.

Ferns.—It is best to purchase young plants in pots from a fern-grower. The best way for increase of stock is by division. This should be undertaken in February when plants have completed their resting period and young growths are appearing. Pieces should be potted into the smallest pots that will contain them, and whether they make good plants or not depends on the skill with which they are watered. Do not split up ferns every year.

Good soil for ferns: Fibrous loam broken into pieces, fibrous peat, good oak-leaf soil, charcoal, brick dust, and sharp silver sand. Thoroughly mix and make firm.

Substitute: Garden loam, good leaf mold, sand, and little bone-meal.

Ferns need careful watering, since when full-grown they dry out quickly. If they wilt put them bodily in pan or tub of water for a few hours. Do not water from overhead; they like moist atmosphere and not too bright sunshine.

The most suitable varieties for the greenhouse are: *Adiantum Capillus-Veneris; A. cuneatum; A. gracillimum; A. farleyense; Pteris cristata; P. tremula; P. cerrulata; P. cretica; Nephrolepis exaltata; N. Duffii; N. davallioides.*

Asparagus fern.—*A. plumosus* for bouquets; *A. Sprengeri* makes basket plant. Both are increased by division. Use good potting soil and make it firm. Flourish best when kept somewhat warm.

Ficus elastica (rubber plant).—This plant has a hardy constitution and will bear ill treatment. Plants may be obtained from cuttings. The usual method is notching and ringing. Leaves should be frequently sponged. Any good potting soil can be used. *Ficus repens* is a pretty clinging plant.

Ivy.—Propagation by cuttings. They can be rooted in water or better in sand. Good for hanging pots.

Palms.—Very easily grown, but neglect in watering will soon produce brown tips to the leaves. Failure to give adequate shading will develop brown patches. Fibrous turfy loam is best; add a little mortar, rubble, and charcoal. Palms are slow-growing and need not be stimulated, so avoid manure or other stimulants. Good drainage and firm potting are necessary because palms are not often shifted. Do not put pots directly on earth floor, because worms in soil will soon produce sourness. Syringe foliage frequently and sponge periodically three or four times a year.

Many kinds can be grown from seeds, but it is more satisfactory to buy small plants, and these will last for a great number of years. Useful palms are *Kentia Belmoreana, K. Forsteriana, K. Sanderiana, Cocos Weddelliana, Phoenix Roebelenii,* and *P. dactylifera* (date-palm).

Philodendron.—A very attractive plant. It is easily grown after rooting. Propagation by cuttings. These can be rooted in water as well as in sand.

Sansevieria, *Sedum*, *Zebrina pendula* (Wandering Jew), *Echeveria* (hen-and-chickens).—Propagation by cuttings.

BULBS

General directions for planting bulbs.—Best not to force most bulbs before early spring. Plant in 5- or 6-inch pots—several in each pot. Soil: loam and leaf mold, sand and bone meal.

Fill pot one-half or two-thirds with soil or until bulb when placed on the soil comes not quite to top of pot, then press soil around the bulb till within 2 inches or so of top of pot. Water thoroughly after planting. Not too high temperature. Place in dark until good root system is developed; bring to subdued light in about 50° F. temperature; after foliage is dark green bring to full light and higher heat. The slower the forcing the better the flowers. Do not let root system become dry during development of blossom.

Amaryllis.—Only large bulbs bloom first year. Avoid repotting.

Calla lilies.—Place in sunlight in December. Apply weak dose of liquid manure twice a month. Will flower in late spring. Roots should be dried off and laid under bench rest of year. "Godfrey" a good variety.

Easter lilies.—Seven- to 9-inch size best. Potted in December for Easter; potted in August or September for Christmas. Potted first in 4-inch pots; place in cool dark cellar. Christmas ones should be put on benches in cool greenhouse and pot covered with sphagnum moss. As soon as root action shows put in a temperature of 50° F., increase to 60-70° when top is well developed.

Freesias.—Plant in August, November, or February; will flower in 4 months.

Gladiolus.—For early forcing use early-ripened bulbs. Plant in November, December, or February—flower in 5 months.

Lilies-of-the-valley.—Berlin pips best; 6 to 12 in a pot.

Narcissus.—Many bulbs flower in 10 weeks after planting. Not too high temperatures; place in dark after potting.

Snow-drops.—Bloom early in March.

CHART OF FLOWERING PLANTS

Name of plant	Method of propagation	Temperature (degrees F.)	Time of planting	Time of blooming	Where planted	Use
Ageratum	Cuttings	50	Dec.-Oct.	Mar.-Jan.	Pots	Pot plant
Alonsoa	Seeds	50	Nov.	Mar.	Pots	Pot plant
Alyssum	Seeds	50	Nov.-Mar.	Feb.-May	Pots	Pot plant
Antirrhinum	Cuttings		Aug.-May	Mar.-Nov.		
	Seeds	50	Nov.	May	Soil, pots, bed	Cut flowers
Aster "Queen of the Market"	Seeds	48	June-Mar.	Sept.-June	Soil, pots, bed	Cut flowers
Begonia	Plants	85	Jan.	Mar.	Pots	Pot plant
Blue-lace flower	Seeds	50	Sept.	Mar.	Pots	Pot plant
Buddleia	Cuttings	55	Mar.	Dec.	Pots	Pot plant
Calceolaria	Seeds	45	July	Mar.	Pots	Cut flowers
Calendula "Orange Prince"	Seeds	55	Sept.-Nov.	Feb.-Mar.	Pots	Cut flowers
Candytuft	Seeds	50	Jan.	June	Pots	Cut flowers
Carnation	Cuttings	50	Feb.	Sept.	Soil, pots, bed	Pot plant, cut flowers
Chrysanthemum	Cuttings	50	Jan.-Mar.	Oct.-Nov.	Soil, pots, bed	Pot plant, cut flowers
Cineraria	Seeds	50	June-Aug.	Dec.-Mar.	Pots	Pot plant
Clarkia	Seeds	50	Oct.	Mar.	Pots	Pot plant
Columbine	Seeds	50	Feb.-Oct.	Mar.-June	Pots	Pot plant
Cosmos	Seeds	50	Sept.	May	Pots	Cut flowers
Cyclamen	Plants	50	June	Dec.	Pots	Pot plant
Cynoglossum	Seeds	50	Sept.-Feb.	Mar.-June	Pots	Pot plant
Cytisus	Cuttings	50	Feb.	Apr.	Pots	Pot plant
Delphinium	Seeds	50	Jan.-Nov.	June-Mar.	Soil, pots, beds	Pot plant
Dianthus	Cuttings	50	Nov.	June	Pots	Pot plant

CHART OF FLOWERING PLANTS

Name of plant	Method of propagation	Temperature (degrees F.)	Time of planting	Time of blooming	Where planted	Use
Freesia	Cuttings	50	Jan.	June	Pots	Pot plant
Gardenia	Cuttings	75	Dec.	.....	Pots	Pot plant
Geranium	Cuttings	50	Oct.	April	Pots	Pot plant
Hydrangea	Cuttings	50	Jan.	Jan.	Pots	Pot plant
Jerusalem cherry	Seeds	50	Jan.	Dec.	Pots	Pot plant
Lupine	Seeds	48	Sept.-Jan.	Jan.-May	Pots	Pot plant
Marguerite (Paris daisy)	Cuttings	50	Nov.	Mar.	Pots	Pot plant, cut flowers
Mignonette	Seeds	50	Oct.-Feb.	Feb.-Dec.	Pots	Pot plant
Myosotis	Seeds	50	Sept-July	Jan.-Mar.	Pots	Pot plant
Nemesia	Seeds	50	Jan.-Nov.	Apr.-May	Pots	Pot plant
Nicotine	Seeds	50	Nov.	April	Pots	Pot plant
Pansy	Seeds	45	Sept.-July	Feb.-Dec.	Pots	Pot plant, cut flowers
Petunia	Seeds	50	Jan.-Nov.	May.-Apr.	Pots	Pot plant
Phlox	Seeds	50	Oct.	Feb.	Pots	Pot plant
Poinsettia	Cuttings	50	Aug.	Dec.	Pots	Pot plant
Primrose	Seeds	50	Feb.	Jan.	Pots	Pot plant
Salpiglossis	Seeds	50	Sept.	May	Pots	Pot plant
Schizanthus	Seeds	50	Nov.-Mar.	May-Nov.	Pots	Pot plant
Stock	Seeds	50	Aug.	Jan.	Pots	Pot plant
Swan River daisy	Seeds	45	Sept.	May	Pots	Pot plant
Sweet-pea	Seeds	50	Sept.-Nov.	Dec.-May	Pots	Pot plant
Violet	Cuttings from terminal shoots	50	Mar.	Dec.	Pots	Cut flowers
Wall-flowers	Seeds	50	Jan.-Mar.	Jan.-Mar.	Pots	Pot plant
Zinnia	Seeds	50	Jan.	July	Pots	Cut flowers

SUN-PORCH GARDENING

The average sun-porch has more than enough light for growing house plants successfully. Its commonest fault is the dryness of the air, but this could be somewhat remedied by installing humidifiers in connection with the heating system. Gas and unfavorable temperature are other conditions which make growing plants in the house difficult. Many house plants will not stand up under the trying conditions to which they are exposed on the average sun-porch. The following list contains only those which have proven hardy and reliable after repeated trials. All of them are plants which can be propagated in water as described in the article on "Gardening with the Handicapped Homebound."

In addition to these foliage plants there are several shrubs, often planted about hospitals and public institutions, whose branches might be forced into bloom during the winter to brighten up hospital porches or occupational therapy workshops. The most reliable flowering shrub to force, as well as one of our commonest, is the golden-bell or Forsythia. The common pussy-willow and the Cornelian cherry *(Cornus mas)* are almost as good though not as commonly planted. Crab-apples, pears, and Japanese quinces can also be used, but they are not as reliable. The branches can be cut at any time after the first of January and for forcing are merely placed in water in a sunny window.

RELIABLE FOLIAGE PLANTS FOR SUN PORCHES

Aspidistra
Bryophyllum
Cyperus
English ivy
Philodendron
Rubber plant
Sansevieria
Showy sedum
Wandering Jew

PLANTS FOR WINDOW BOXES

Water very thoroughly.
Petunias and nasturtiums.—Planted at sides, droop over as vines.
Fuchsia.—Eastern exposure best (not too sunny).
Geranium.—Combined with pale lavender ageratum.
Pansies.—For north window.
Heliotrope.—Sunny window.

Blue lobelia, white and sweet candytuft.—Excellent to plant at end of box.

Vines.—Best are wandering Jew, English ivy, moneywort, *Vinca major*, and Glechoma.

Coleus.—Scarlet, Golden Feather, Trailing Queen.

Dusty Miller.—Centaurea.

Scarlet salvia.

Swan River daisy.—Very attractive plant for hanging pots.

FLOWER GAMES

In working with crippled or bed-ridden children it is often useful to know interesting myths about common flowers, simple games that can be played with plant material, or flower structures which have a fancied resemblance to some other object. Following are some of the plants and their uses in this work:

Pansies and violets.—After the petals are pulled away the stamens and pistil look like "an old man with his feet in the foot-bath." The spur of the flower forms the bath; the stamens, the blanket around the old man's shoulders.

If two violets are hooked together by their spurs they may be used in wishing games. When the stems are pulled, one of them will break; the player holding the unbroken violet is the winner.

Poppies.—Very lifelike dolls can be made from poppies. Use freshly opened flowers, as older ones shed their petals too easily. Turn the petals back on the stalk and bind them with a spear of grass to form a waist and skirt. Cut off a short piece of stem and use it for arms. The seed pod forms the head, and part of the stamens are left to form a ruff in the back.

Catalpa.—Catalpa flowers make good hats for clothes-pin dolls or for little men whose faces have been inked on one's thumb nail.

Snapdragon.—Squeezing the flower sideways between the thumb and finger will give the effect of a dragon opening and closing his mouth.

Buttercups.—The flower is held under the chin. If the gold color is reflected by the skin it indicates a love for butter.

Dandelion.—After the flower has gone to seed it is used in an old-fashioned "wishing game". A wish is made and then the seeds are blown away. It will take as many years for the wish to come true as it took breaths to blow the seeds away.

Honeysuckle.—There is enough honey in the spur of the flower to taste distinctly sweet.

Showy stonecrop.—If a leaf is sucked until the upper and lower epidermis are separated, it can be puffed in and out like the skin on a frog's throat.

Touch-me-not or Impatiens.—Sometimes called "gold and silver," because the flowers are golden, and when the leaves are held under water they look as if they had been dipped in molten silver.

Poplars and aspens.—The Lombardy poplar holds its arms up straight because when the trees were asked which one was hiding the pot of gold the poplar lied and has had to hold up his arms as a punishment.

The cross upon which Christ was crucified was made from an aspen tree, which shocked the rest of the aspens so much that they have quivered ever since.

Maples.—Maple-seeds give a resounding snap when they are stamped upon, and also furnish realistic eye-glasses.

Love-in-a-mist.—The seeds have the flavor of artificial grape.

Vegetable circuses.—A whole circus can be made from common garden vegetables and toothpicks. A cucumber makes a splendid canoe if it doesn't have to float upon the water; and it also can be fashioned into a chariot. A summer squash also provides us with a chariot, with radishes as wheels and people. Horses can be made from snap-beans, with toothpicks for legs.

Many plants have interesting odors; yarrow, pennyroyal, and tansy being three common examples. Sassafras has three distinct smells: one from the leaves, one from the bark, and the third from the root-bark.

THE SMALL GREENHOUSE

1. *Construction*—

A profitable size for a small greenhouse would be 50 x 18 feet with maximum height of 12 feet. This could supply the

hospital to which it was attached with foliage plants and some cut flowers throughout the year. Such a house should be divided into two sections, one 30 feet long for the cultivation of the plants, and one 20 feet long for propagation and experimental uses. The range should be from north to south and far enough from tall buildings not to be shaded. This size of house, if made with purlin pipe frame, would cost around $1.50 per square foot, or about $1500 without any shading equipment.

The concrete foundation should be 3 feet under ground with wall 3 feet above the ground. The house should be 5 feet from eaves to ground. The curved roofs have no special advantage aside from a neat appearance and are more expensive. The glass panes should not be larger than 16 x 24 inches. The mullions should have drip conductors.

A greenhouse must furnish heat, ventilation, and shading, as well as an abundance of light.

The temperature should be from 60 to 65° F., a little lower at night. Steam or hot-water heat or both may be used. This will probably come from the hospital or a central heating plant. Care should be taken to avoid over-piping of the house. Steam pipes should be broken up in 2-coil units with 4 double runs of coil under the benches. Pressure should be reduced to 4 or 6 pounds with possibly 7 or 8 in zero weather.

The sides and part of roof should be arranged so that they can be raised to permit ventilation, one-tenth of roof and the sides being movable.

Shading of a greenhouse is very important, and there must be some arrangement for shading it partially or completely. The roller-lath blind is best but costs from 75 cents to $1.50 per square foot. This same type can be made in the occupational therapy shop from laths and ropes. The commercial porch shading can also be used, but it only lasts from two to three years.

The benches should be of pecky cypress with concrete supports (cast-iron forms can be purchased for molding these). Supports should be about 4 feet apart with the 2 x 4-inch supports resting on them, and benches laid on top of these supports.

Benches should be 3 feet wide and from 6 to 10 inches deep, or for deep-soil bench 18 inches deep and run from end to end of the house. In an 18-foot house there should be three benches, with cinder walks 3 feet wide between. The benches should be placed at least 2 or 3 inches from the wall of the house, as heat must circulate to all sides or those plants toward the outside will be frosted in cold weather.

The potting shed might be used as a connecting room between hospital and greenhouse.

2. *Management*—

A. Principles for management of plants:

1. Each plant has its own season of bloom. Each should be given as nearly as possible the normal conditions for growth; never fit plant to the environment but make environment fit the plant.

2. Most plants demand seasons of activity and rest; usually rest in winter and bloom in summer (bulbs and tubers show plants need rest).

3. The greater part of growth should be made before the plant is expected to bloom. The stronger and better the plant, the better the bloom. Too much shifting from pot to pot is a serious evil. When plant reaches desired size it should be allowed to bloom; liquid manure or other fertilizer may be applied at this time.

4. Sand-bed is good for propagation of cuttings in most cases.

5. Ordinary clay pots are very good, but glazed pots are not to be condemned. Hanging plants do best in glazed pots. Pots should be chosen with regard to roots of plants. Pots are nearly as important as soil. Drainage is very necessary.

B. Principles primarily for management of the house:

1. Heat should imitate natural day conditions (periodic temperature). It should be lowest before dawn and gradually rise till mid-day or little later. The night temperature should be 10-15 degrees below maximum day temperature. (High night temperature causes the plants to mature too early, with weak and flabby flowers).

2. Every plant to receive individual care.

3. There should be no vacant places on greenhouse bench. Care should be taken to arrange house so that every plant will have chance to develop.

4. Every precaution should be taken to prevent plants from becoming diseased. (See Fumigation.)

5. The higher the temperature, the more rapid the growth, and the greater care necessary. (Plants become soft and juicy in high temperatures.)

6. In darker weather grow plants "slow".

7. Apply water when plants need it. Water thoroughly at each application. Water in rising temperature. Never water in evening as wet foliage at night might cause "damping-off" disease.

8. Soil should be well composted and contain leaf mold, sand, very little silt or clay.

9. Ventilation is practised for the purpose of reducing temperature and lessening moisture of atmosphere.

10. Most plants require shading in summer under glass.

3. *Bibliography—*

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4. *Fumigation and Spraying—*

Mealy bugs—Apply oil emulsion with pointed stick.

Aphids—Spray with an oil emulsion or nicotine spray; burn Aphis Punk.

Sow bugs—Sprinkle para-dichloral-benzine in trench around plants and cover with dirt.

Plant diseases—Spray with Bordeaux mixture; spray with one of the organic mercury sprays on seed pans to control "damping-off."

Spray or fumigate only on cloudy days or in the evening. Have the plants dry when they are fumigated.

Keep house clean; no rubbish under benches. Give proper ventilation, right kind of atmosphere, temperature, and watering. This with regular spraying or fumigation will keep out aphids and a start will have been made toward healthy stock.

THE SNOW STORM OF MAY 2

The almost unprecedented snow storm of May 2 did more damage to the Garden than the cyclone of September, 1927. A few trellises were thrown down by the weight of snow and a section of the pergola in the Italian garden was broken by a falling tree, but the brunt of the damage was borne by the smaller shrubs and perennials. The peonies, which were in full bud, were snapped off close to the ground, and the same fate befell innumerable small shrubs. Many of the large trees suffered the loss of branches, and in some instances the tops were broken out, causing such serious disfigurement that some trees will have to be removed altogether. In cases where the tree was fifty or more years old and the only one of its kind at the Garden, the loss is a serious one. A specimen of Cladrastis, or yellow-wood, whose masses of white bloom in the spring formed one of the sights at the Garden, was half torn away and sadly disfigured. Another one of our highly prized trees, a Scotch elm, between forty and fifty years of age, lost its top, and many similar cases might be enumerated. The work of repairing the damage done by the cyclone of 1927 had just been completed this spring, and now the Garden is faced with at least a year's surgical work in erasing the results of the snowfall.

Following is a tabulated list of the damage done to the trees in the Garden:

Trees destroyed:

4 Ash
1 Birch
1 Box-elder
1 Buckeye
3 Cottonwood
1 Empress tree
9 Hawthorn
1 Lombardy poplar
1 Mulberry
1 Oak
2 Sassafras
2 Wahoo

Trees necessary to reset and brace:

2 Box-elder
5 Elm
1 Ginkgo
6 Hawthorn
2 Wahoo

Trees seriously, and in many cases permanently, injured:

3 Apple
10 Ash
3 Basswood
11 Birch
10 Box-elder
7 Buckeye
5 Buckthorn
3 Cherry

Trees seriously, and in many cases permanently, injured:

3 Cherry (wild)	2 Plum
10 Cottonwood	3 Red oak
20 Elm	1 Silver Bell
3 Ginkgo	5 Sycamore
2 Gum	1 Tulip tree
1 Hackberry	1 Tupelo
24 Hawthorn	1 Varnish tree
2 Locust	11 Wahoo
4 Lombardy poplar	1 Willow
4 Magnolia	2 Yellow-wood
6 Maple	1 Zelkova
1 Osage Orange	

NOTES

Dr. George T. Moore, Director of the Garden, spoke at the University Club, May 12, on "Morality in Plants."

Mr. L. P. Jensen, Arboriculturist to the Garden, gave a lecture on "Trees" before the St. Louis Scout Masters' Nature Study Class, at the Michael School, May 6.

Mr. L. P. Jensen, Arboriculturist to the Garden, is the author of an article in the March-April issue of *Parks and Recreation*, on "Planting for Winter Effect."

The Garden had an exhibit of one hundred square feet of flowering orchids at the St. Louis Horticultural Society Flower Show, at the Famous-Barr auditorium, May 16-18.

The annual flower sermon, instituted by Henry Shaw to commemorate the goodness of God as revealed in flowers, was preached at Christ Church Cathedral, May 12, by the Rev. Phillips E. Osgood, D. D., Rector of St. Mark's Church, Minneapolis, Minn.

Professor H. W. Rickett, assistant professor of botany, University of Missouri, was in charge of a party of students in botany from that university which visited the Garden, May 18. After a tour of the library and herbarium a luncheon was served, and the party was then conducted through the various greenhouses and gardens.

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the science section of the Wednesday Club, May 1, on "The Great Conflict: The Rising Tide of Insects"; before the Women's Round Table, May 15, on "Plant Families"; and

before the P. E. O. of Webster Groves, Mo., May 24, on "The Rising Tide of Insects."

Mr. George H. Pring, Superintendent of the Garden, has given the following talks recently: "Cultivation of Orchids," April 25, before the Fortnightly Club of Kirkwood, Mo., and May 1, before the Wednesday Club of East St. Louis; "Orchid Exploration in the Andes of Colombia," May 7, before the Business and Professional Women's Club of St. John's Episcopal Church, and May 13, before the Traffic Club of St. Louis.

On May 12, Mr. L. P. Jensen spoke before the Junior Chamber of Commerce, who were guests of the Garden at the Gray Summit Extension, on "The Missouri Botanical Garden Extension." On May 24 the Osage Hills Garden Club visited the Gray Summit Extension, and Mr. Jensen gave a talk on "Native Plants."

STATISTICAL INFORMATION FOR APRIL, 1929

GARDEN ATTENDANCE:

Total number of visitors	29,590

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	84
Total number of books and pamphlets donated	219

PLANT ACCESSIONS.

Total number of plants and seed packets donated	994

HERBARIUM ACCESSIONS—

By Gift—

Anderson, Dr. E.—Plants of Kansas, etc	10
Grant, J. M.—Fungi of Washington	7
Hume, H. Harold—*Erythrina Crista-galli* L. (*E. laurifolia* Jacq.) from Florida	1
Roush, Mrs. Eva M. Fling—*Arctostaphylos Uva-ursi* (L.) Spreng. from Indiana	1
Showalter, Prof. A. M.—Plants of Missouri	4
Woodson, Robert E., Jr.—Photographs and seeds of *Apocynum*	5

By Exchange—

Drushel, Prof. J. A.—Plants of the eastern and central United States	150
Jardin Botanique, Brussels, by Dr. E. de Wildeman—Fragment of the type of *Halenia longicornu* M. & G.	1
Montero, Prof. G. —Plants of Chile	50
Pomona College, by Prof. P. A. Munz—Onagraceae	68
Total	297

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1929

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

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WHAT GOES ON AT THE MISSOURI BOTANICAL GARDEN; A BIRD'S-EYE VIEW OF ITS VARIOUS ACTIVITIES

A GUIDE TO THE EXHIBIT ON DISPLAY DURING JULY, AUGUST, AND SEPTEMBER

Well over a thousand people a day, on the average, pass through the little clicking turnstiles at the main gate to visit the Missouri Botanical Garden. To most of them the Garden is just a place where one goes to see flowers; the big orchid show and the "mum" show in the winter time; the iris garden with its 1500 different varieties in the spring; and the tropical water-lilies throughout the summer. However, among the daily thousand there are a few, perhaps a hundred, who know that the exhibition of flowers is only one of the many activities of the Garden. They know that there is a large red-brick building housing a library and herbarium, that the institution has a 1600-acre reservation at Gray Summit, Missouri, and a tropical station on the Canal Zone, and they have heard that different kinds of experiments are being carried on behind the long gray-stone wall that Henry Shaw built so many years ago.

But not all of the hundred who have heard of these other activities understand in even a general way what they are and why they are undertaken. Yet those people who understand what they are seeing enjoy their visit more and look back to it with greater pleasure. If it were possible the Garden would like to play the host to all its visitors and accompany them around the grounds and buildings, showing them all the different kinds of work in progress. Unfortunately, that is not the sort of thing which can conveniently be done with 1200

people a day, and to take its place there has been installed in the floral display house an exhibit entitled, "What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities."

This account is published for several reasons. First, it will tell readers of the BULLETIN about the exhibit and indirectly bring to their attention a good many facts concerning the Garden with which they are not acquainted. Second, it will serve as a printed guide to supplement the exhibit, as many visitors will want to know a little more about several points than could well be included on a label. That "little more" will be provided by the following account, which for convenience has been divided into sections that correspond with the exhibits. Finally, an increasingly large number of school teachers bring their classes to the Garden, and this guide has been prepared primarily for school children in order to make such visits more interesting and worth-while.

HENRY SHAW: THE FOUNDER OF THE MISSOURI BOTANICAL GARDEN

Unlike most botanical gardens, the Missouri Botanical Garden was the creation of one man, Henry Shaw. The Garden grounds were once his country home, built on the fertile *Prairie des Noyers* outside the growing city of St. Louis. He was a native of Sheffield, England, who came to this country as a young man and established himself in business in St. Louis. In 1840 he retired from active life, and it was shortly afterwards, while on a trip around the world, that he conceived the idea which eventually resulted in the Missouri Botanical Garden. He opened the Garden to the public about 1860, and from that time until his death in 1889 it was maintained under the personal direction of its founder. While virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden," the name Missouri Botanical Garden was designated by Mr. Shaw as its official title, and in his will and in all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands

of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

THE MISSOURI BOTANICAL GARDEN; A WORLD-WIDE INSTITUTION

Appropriately enough for a bird's-eye view, first a glance is given the institution as a whole, and then "close ups" of the various departments. That first cursory glance takes in the whole world, for the Garden has grown into a world-wide institution. It is world-wide in the location of its various branches. There is the original garden here in St. Louis; sixteen hundred acres in the Gray Summit Extension at Gray Summit, Missouri, some forty miles to the west of the city and probably well outside any smoke zone; a special tropical station in the Canal Zone, on land belonging to the Government, where the original Powell collection of orchids and later additions may have the advantages of tropic heat and tropic rainfall; and there is a permanent representative in England, who keeps the Garden in touch with the latest horticultural developments in Europe.

The Garden is world-wide even more in its influence and its contacts. Its publications go to every corner of the globe; it has collectors and correspondents in the most out-of-the-way places; and from time to time it sends out expeditions of its own for plants and specimens. It is no unusual thing for a day's mail to bring a query from Australia as to where certain American plants can be obtained, or a package of seeds from a remote part of China, or a bundle of specimens from the jungles of the Amazon.

P-R-I-C-E

The Garden employs for all purposes about 65 people, each of whom has his own particular duties. There is, for instance, a woman who spends her time mounting dried plants

on stiff paper, so that they can be filed away for study; a man whose entire time is taken up in directing the pruning and care of trees and shrubs; there are the employes in the heating and construction departments, and the clerical and scientific staffs. It is somewhat of a problem to group the various activities of all these people under a few headings so that the interested visitor may gain an idea of the work of the institution as a whole. The five headings under which the work of the Garden has been grouped for the exhibit are: *P*ublication, *R*esearch, *I*nstruction, *C*ollection, *E*xhibition, and they may be easily remembered because their initials spell the word PRICE.

PUBLICATION

If the work which is being done at the Garden is to be of any use there must be some means of letting gardeners and scientists, here and in other parts of the world, know about it. For this purpose the Garden maintains two publications of very different sorts. One, this BULLETIN, is of a semi-popular nature and is for the information of people in general. It is sent every month to many schools and institutions in Missouri, and to a large number of subscribers who pay the nominal price of one dollar a year for its ten numbers.

Some of the articles in the BULLETIN have been very useful and have had a far-reaching influence. One month the BULLETIN told about balsa wood, which is only half as heavy as cork. Within a week or so makers of cork-legs, airplanes, automobiles, and all sorts of other things in which light weight is a factor, wrote for information; and later a great commercial company with a capital of over a million dollars was organized to import balsa wood. Another time an article which told in detail how to make plants grow from seed was copied in four different magazines, and one florist in the state of Washington borrowed the illustrations and at his own expense distributed thousands of reprints of the article. Many similar examples might be given, for scarcely a month passes without one or more articles in the BULLETIN being republished.

The other publication, the "Annals of the Missouri Botanical Garden," tells what the specialists working at the Garden have found out about plants. It is full of technical terms and would not be interesting reading for the general public. Through its wide circulation scientists all over the world are able to profit by the experimental work that is being done at the Garden and which is described in the next section.

RESEARCH

Re-search means searching again and again and finding out what is true. The Garden is one of the recognized world centers for research work in connection with plants. When facts about plant life have been determined, people know what plants to grow, how to grow them, how to protect them from insects and diseases, and how to improve them.

A good example of the research work done at the Garden is Dr. H. C. Young's study of sulphur and plant diseases. It had been known for some time that sulphur protects plants from disease, and sulphur sprays had therefore been developed which were very widely used. No one, however, had studied the subject closely enough to find out just how the sulphur helped the plants fight the disease. It was not even known just what compound or compounds of sulphur were effective, and under what conditions they could operate. Dr. Young proceeded to determine these very points. He grew hundreds of samples of representative plant diseases, keeping his little disease gardens in small glass dishes and feeding them on nourishing broth. It may seem queer to talk about growing a disease, but most plant diseases (wilts, rusts, and the like) are really little plants themselves. Thus he was able to study the way the diseases reacted towards different sulphur compounds, and he finally proved just what compound of sulphur is the most successful in controlling diseases and what conditions are necessary for it to work effectively. With this definite information, other scientists are now developing a sulphur spray that will do the work better and be less expensive than the sprays formerly in use.

There are many different kinds of research work being carried on at the Garden. Some of it, like Dr. Young's, has

an almost immediate practical bearing. Much of it merely adds its little bit to the sum total of what is known about the world in general and about plant life in particular. Scientists have found that it is best to work in this way, putting bits of information together little by little and not caring how soon it will be needed. Sometimes it will at once be generally useful; often a hundred years goes by before any practical application is made of the discovery. An Austrian monk, Gregor Mendel, discovered certain fundamental laws about the way plants (and animals) pass on their characteristics to their offspring. It was not until long after his death that his work was taken up by other scientists, and it was not until they had made many more experiments along the same line that his theory was developed to a point where it was of practical importance. Yet to-day the discoveries of Mendel and his followers are being used in a practical way in breeding corn, wheat, tobacco and many other useful plants all over the world.

Much of the research work done at the Garden is in the field of taxonomy. Taxonomy is the science which deals with the classification and naming of plants. It is the oldest branch of botany and still the most fundamental one. Though botanists all over the world have been studying and naming and classifying plants for some hundreds of years the work is only just begun. There are large groups of plants which have not yet been carefully studied, and there are many parts of the world which have not been carefully explored to find out what plants grow there. The Garden is one of the great world centers for taxonomy because, as is told in the section on "Collections," it has one of the largest and most important collections of dried-plant specimens and one of the largest libraries dealing with the subject of plant classification.

Besides studying the plants already assembled in its collections, the Garden sends out expeditions from time to time to explore little-known regions. Some of the most important recent expeditions of this sort are Dr. Greenman's trip to Central America in 1921, and Mr. Pring's journey across the Andes of Colombia in 1923.

INSTRUCTION

The Garden carries on two very different kinds of educational work: a graduate school of botany in co-operation with Washington University; and instruction in gardening.

In 1885 Henry Shaw endowed a school of botany in Washington University which was named in his honor, the Henry Shaw School of Botany. All of the undergraduate, and a part of the graduate, work is given at Washington University. Because of the library, herbarium, and other facilities available at the Garden, as well as the scientific staff, a considerable number of graduate students carry on the major portion of their work here. The graduate school, as its name implies, is open to college graduates who wish to gain new knowledge about plant life by means of research. There are relatively few places in the country where this kind of training can be obtained, and the Henry Shaw School of Botany is a recognized center for such work. Students come from all over the world to work with the specialists at the Garden, to use the laboratory equipment, and to consult the library and the collection of dried plants (herbarium). Some of them stay for only a year, but many of them study for three or more years to obtain a Doctor's degree (Ph. D.) from Washington University for the original research work they have carried on at the Garden.

Instruction in botany is one of the activities of the Garden in which Mr. Shaw took an especial interest and for which he made definite provision in his will. It was therefore started soon after his death and many of the most important botanists in this country and in other countries have received their technical training, in whole or in part, at the Henry Shaw School of Botany.

It was also Mr. Shaw's express desire that the Garden should help train young gardeners and be a center of horticultural information. The first of these objectives is met by a system of apprenticeships. The apprentices are young men who have decided to become practical gardeners and who work and study at the Garden for a series of years until they have gained experience. They are shifted from one department to another, learning how to raise plants from seed,

how to make cuttings and grafts, how to care for plants, and destroy harmful insects and plant diseases.

The Garden also gives a number of short courses for amateur gardeners, the nature of which varies from year to year. A course is given whenever a sufficient number of people make known their interest in a particular subject. During the spring of 1929, for instance, there was a class which met every Saturday afternoon during March, April, and May, for the study and identification of native Missouri plants. Another course gave training in simple horticultural practices, such as seed sowing, making cuttings and grafts, transplanting seedlings, spraying, etc.; and there was also a course in vegetable growing.

COLLECTION

Perhaps a better title for this section would be "Collection and Classification." Science is more than a collection of facts; it is an ordered collection of facts. The great collections at the Garden are useful to the world because they are more than mere assemblages of plants or specimens or books; they are *classified* collections, and the knowledge and data they contain is readily available because of the classification.

1. Collection of Books.—It is through books that we find out, not only what is being done here at the present time, but what *is* being done, and *has* been done, all over the world. The facts which have been laboriously found out about plants have been published in all sorts of books and magazines. Some are great tomes written in Latin and bound in tooled leather or parchment and some are tiny little pamphlets of a few pages. There have been well-supported periodicals which have continued for over a century, and there have been journals which barely published their first number before they expired. A good botanical library includes them all.

Most people know that scientists need laboratories and special equipment, but few realize that libraries are even more necessary. Before an important experiment is undertaken the experimenter must know what has been learned about that subject. There are many scientific institutions in this country which are badly handicapped because, though they

have fine buildings and good equipment, they do not have good scientific libraries. Thanks to the wisdom and foresight of Mr. Shaw, the Garden has never been handicapped in this way. He was well enough informed to know that a good library is a very vital part of a scientific institution and before his death, with the help of his friend, Dr. George Engelmann, he had amassed a very considerable botanical library. It formed the nucleus of the present collection which is now one of the most important botanical libraries in the world.

2. Collections of dried plants (herbarium).—The advice of Dr. George Engelmann was also very helpful to Mr. Shaw in starting an herbarium, and he is largely responsible for most of the important additions made to the herbarium during Mr. Shaw's time.

Herbaria are collections of dried plants which are used in studying and classifying species of plants. Since few botanists can afford to travel all over the world to examine the plants they are trying to classify, it is necessary to have these large collections of specimens from all parts of the globe. Each specimen is mounted on stiff white paper, called an herbarium sheet. All the sheets of a species are placed in a folder, and these folders are kept on shelves in steel cases. About one-third of the main building at the Garden is filled with these steel cases, containing in all about a million sheets.

The Missouri Botanical Garden Herbarium is one of the most important in this country. Its exact rank is difficult to determine, because some herbaria are particularly good in one line, some in another. However, it is certainly among the first half dozen in the United States, and it has helped to make the Garden one of the recognized world centers for herbarium work.

3. Collections of growing plants.—Most visitors know more about these collections than they do about the books and the herbarium specimens. The plants are available for observation by every one. Probably the most interesting single outdoor collection is the iris test garden, maintained in cooperation with the American Iris Society. Here are some 1500 different varieties of garden iris, arranged according to

color. During blossoming time thousands of gardeners come, sometimes from several hundred miles, to study the different varieties and to determine which kinds they want to use in their own gardens. Other collections worthy of note and available for study at the proper season are the medicinal garden, the economic garden, the water-lilies, the rose garden, etc.

EXHIBITION

Very little need be said about this phase of the Garden's work, since it is the one activity about which every one knows; in fact, many people suppose it is the only work carried on by the Garden. The exhibits may be roughly classified as flower shows and regular exhibits. The former are those special exhibitions which are staged in the floral display house from November to June. Originally there was only one big show, the chrysanthemum show, but now there is practically a "continuous performance" all winter. The chrysanthemum show is still one of the biggest attractions but the orchid show, the poinsettia show during the holidays, and the spring bulb show are almost as popular. It should be borne in mind that these exhibitions differ from the flower shows one ordinarily attends in that everything is grown by the Garden and is not the work of some one else. Attendance at these exhibits has increased very largely in recent years, until in 1928 it reached the astounding total of 468,000 for the year, which means an average of over 1200 people a day for the 363 days the Garden was open to the public.

Smoke.—Before taking up the Gray Summit Extension, a section of the show is devoted to one of the main reasons for establishing such an extension to the city garden. Smoke is now our greatest enemy. The evergreen trees for which the Garden was once famous have been entirely killed and most of the other trees have been badly stunted. Smoke injures plants in more than one way. In the first place it cuts out a great deal of sunshine, and in the winter sunshine means everything to greenhouse plants. Plants are living beings, and need to breathe. They do not have one large pair of nostrils as animals do, but many little openings scattered all over the surface. Smoke clogs these up and literally smothers

plants. In addition, there are poisonous gases in smoke, and these work great havoc, particularly at times when there is a heavy smoke fog. After one of these heavy fogs many tropical plants at the Garden lose all or part of their leaves and most of those which remain are sick and discolored.

Smoke is such an important factor in the life of the Garden that a scientific study of it has been carried on for several years. The first Owens' Automatic Air Filter to be imported into America is to be found at the Garden, where it has been in continuous operation since its installation. By the simple operation of pulling a measured quantity of air through a filter paper the amount of suspended impurity in the air from hour to hour and from day to day is recorded. These records become increasingly valuable as time goes on, for they give an exact record of the smoke conditions from month to month and from year to year. By analyzing the records many things can be learned about the origin and nature of the smoke fog and its possible prevention. For instance, a comparison of holiday and working-day records gives a fairly good estimate of the proportion of the smoke due to factories and that caused by homes and apartment houses.

GRAY SUMMIT EXTENSION

For a number of years the trustees of the Garden have realized the desirability of securing a large tract of land outside the city where trees and plants of all sorts could be more successfully grown than in town. It was also recognized that it has been the history of all botanical gardens established within a large city that they were eventually forced to move, and while this time may be very far in the future for the Missouri Botanical Garden, a wise policy dictated that a suitable location be obtained as soon as possible. After examining a number of places, sixteen hundred acres were obtained on the Manchester Road just beyond the town of Gray Summit. Among the many advantages of this location is the fact that it is one of the best places in the state for native wild flowers and that there is already established a representative collection of trees which grow naturally in this locality. With the Meramec River running through the place and with

a variety of soils and the irregular contour of the land, the possibilities for development are almost unlimited. It will be a number of years before the completion of the roads will make it possible for the general public to visit this tract, but even now the extensive nurseries and the collection of orchids now established here are worth seeing.

Orchid collection.—From its very beginning the Garden had grown a few orchids, but it was not until the generous gift of the late D. S. Brown that it could be said to have had anything like a representative lot of these plants. Later, through purchase, tropical exploration, and the gift of the late C. W. Powell, the Garden accumulated what is now universally acknowledged to be the largest and most representative collection of orchids maintained by any public institution in this country. An important adjunct to the orchid collection are the orchids grown from seed obtained by crossing rare varieties. The orchid seed is so small and so poorly adapted for successful growth in this climate that it has to be given very special treatment, and orchids are successfully cultivated in this way in comparatively few places. Since it requires from five to ten years to obtain flowers from an orchid grown from seed, it is impossible to predict the results from the many crosses made and the thousands of seedlings now being grown. It seems certain, however, that many new and valuable forms will be obtained as a result of this work.

Nursery.—As soon as the Gray Summit land was acquired large nurseries were established and stocked with plants obtained from rooted cuttings or grown from seed. Seed, particularly of trees and shrubs, have been obtained from all over the world, and there will eventually be established at Gray Summit a wonderful collection of rare and unusual plants, some of which have never before been grown successfully in this country. This is particularly true of evergreens or conifers. From the start already made it is not too much to hope that in time there will be established at Gray Summit every kind of evergreen that can be grown in this climate. A start is also being made toward varietal apple and nut orchards, collections of rhododendrons, Japanese cherries,

bulbous plants, etc., which cannot help but make this extension of the Garden the equal, if not the superior, of any collection of plants in the temperate zone.

TROPICAL STATION

The Director's visit to Panama in 1926 resulted in the gift to the Garden of the world-famous orchid collection of Mr. C. W. Powell. While it was at first intended to transfer these plants to St. Louis, further consideration resulted in the establishment of a tropical station on the Canal Zone. The Canal Zone Government gave permission to the Garden to use a piece of jungle land in Balboa which after clearing proved well adapted for such a garden. Mr. Powell was made manager and a house erected for him directly across the street from the new station. After his death Mr. A. A. Hunter became manager. While the station is maintained primarily for orchids, there is gradually being brought together here a collection of some of the rare and more interesting tropical plants which cannot successfully be grown in St. Louis, such as the mangosteen, the chaulmoogra oil tree, certain palms, etc.

EUROPEAN REPRESENTATIVE

Europe is still the seat of the greatest gardening activities, and the seed and nursery catalogues issued in this country compared with those of Europe illustrate this strikingly. Novelties and improved varieties of old stand-bys are constantly appearing, and it is usually many years before they can be obtained in the United States. For this reason a representative in Europe, who makes it his business to visit all the leading flower shows, to establish relations with amateurs and commercial concerns, and obtain for the Garden seed of anything and everything calculated to be worth growing here, is an important addition to the staff. Besides, he is able to locate seed of rare plants which may be needed for scientific study of a certain group and is also of great assistance in obtaining all kinds of books and publications needed for the library. Mr. Gurney Wilson, F. R. S., Editor of the Orchid

Review and Secretary of the Orchid Committee of the Royal Horticultural Society, is European Representative of the Missouri Botanical Garden.

DEGREES IN THE HENRY SHAW SCHOOL OF BOTANY

At the commencement of Washington University, June 11, degrees were conferred on graduate students in the Henry Shaw School of Botany, as follows: doctor of philosophy—Everett Fogg Davis, assistant pathologist, West Virginia Agricultural Experiment Station, formerly instructor in botany, Henry Shaw School of Botany; Miss Mildred E. Mathias, Jessie R. Barr Fellow in Botany; and Mr. Robert E. Woodson, Jr., Rufus J. Lackland Research Fellow. The degree of master of science was conferred on Miss Caroline K. Allen, assistant in botany, Mr. Alexander F. Bucholtz, Rufus J. Lackland Research Fellow; Miss Marion Child, Jessie R. Barr Fellow in Botany, and Miss Julia R. Lawrence, Rufus J. Lackland Research Fellow. Miss Allen, Miss Child, and Mr. Bucholtz will continue their work toward the degree of doctor of philosophy. Miss Lawrence has been appointed assistant in botany at Vassar College, Poughkeepsie, New York.

NOTES

Mr. G. H. Pring, Superintendent of the Garden, gave an illustrated lecture on "Water-lilies" before the St. Louis Horticultural Society, June 7.

Among those visiting the Garden recently were Dr. G. H. Cunningham, Government Mycologist, Department of Agriculture, Wellington, New Zealand; and Professor J. A. Drushel, associate professor of mathematics, New York University.

Dr. George T. Moore, Director of the Garden, spoke before the St. Louis section of the American Chemical Society, June 3, on "The Plant Commonwealth." The lecture was illustrated with several reels of motion pictures taken at the Garden which showed in detail the internal mechanism of plant growth.

STATISTICAL INFORMATION FOR MAY, 1929

GARDEN ATTENDANCE:

Total number of visitors.....35,948

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 34
Total number of books and pamphlets donated..... 58

PLANT ACCESSIONS:

Total number of plants donated 130
Total number of packets of seed donated..... 20

HERBARIUM ACCESSIONS:

By Gift—

Bovard, Mrs. Suzanne—Plants of Peru..... 3
Bush, B. F.—Plants of Missouri..... 13
Canaday, Mrs. A. W.—*Oenothera speciosa* Nutt..... 1
Couch, J. N.—Fungi of Jamaica..... 8
Emig, Dr. W. H.—Plants of Colorado..... 20
"The Florists' Review"—Plants of Mississippi..... 2
Greenman, Dr. J. M.—Plant of New Jersey..... 1
Kellogg, John H.—Plants of Missouri..... 15
Lawrence, Miss Julia R.—Plant of Missouri..... 1

By Purchase—

Bot. Garten u. Museum, Berlin—Plants of Bolivia, collected by Dr. José Steinbach..... 300
Heller, A. A.—Plants of California, Oregon, and Washington 335
Lynge, B.—Plants of Novaya Zemlaya..... 77
Sydow, Dr. H.—"Mycotheca germanica," Fasc. 46-49 inclusive, Nos. 2251-2450 incl..... 200

By Exchange—

Field Museum of Natural History—Plants of Illinois, Labrador, Mexico, and Costa Rica..... 190
Fogg, John, Jr.—Plants of Massachusetts 155

Total 1,321

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1929

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Vandeventer avenue car line (No. 33). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

ERNEST S. REYNOLDS,
Physiologist

JESSE M. GREENMAN,
Curator of Herbarium

DAVID H. LINDER,
Mycologist

EDGAR ANDERSON,
Geneticist

ROLAND V. LAGARDE,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

ELINOR ALBERTS LINDER,
Orchidologist

J. CUTAK,
Exotics

J. LANGAN,
Assistant Engineer

A. D. FORRESTER,
Plant Recorder

A. PEARSON,
Painter

J. H. KELLOGG,
Herbaceous and Nursery

H. VALLENTINE,
Carpenter

W. F. LANGAN,
Chief Engineer

GRAY SUMMIT EXTENSION

L. P. JENSEN,
Arboriculturist

D. MILLER,
Orchids

G. GOEDEKE,
Farm

R. E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

Missouri Botanical Garden Bulletin

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De ACOCOTLI QVAVHNAHVACENSI, & TEPOZTLANENSI. Cap. VI.

ACOCOTLIS

ACOCOTLIS
alia Icon.

FIRST FIGURE OF THE DAHLIA EVER PRINTED. FROM THE "NOVA PLANTARUM ANIMALIUM MINERALIUM MEXICANORUM HISTORIA" OF FRANCISCO HERNANDEZ, 1615.

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THE EARLY HISTORY OF THE DAHLIA

"About this time of the year," as the Almanacs say, interest in the dahlia is at its height, for, given a favorable season, there is no plant blooming out-of-doors in early fall in the vicinity of St. Louis which gives such a variety and profusion of flowers as the dahlia. Because of the present active interest in this plant, many are inclined to think that it has been discovered within the present generation. While of course there are constantly being added so-called new varieties which show an imaginary or even a slight variation from a pre-existing form until there are now over 3,000 named varieties, the original wild dahlia has been known for over 300 years. Toward the end of the sixteenth century (1570) Philip II of Spain sent his physician, Francisco Hernandez, to New Spain (Mexico) to investigate the natural history of this country. As a result of this expedition, Hernandez published in 1615 four books on the plants and animals of Mexico in which he describes three forms of "an herb bearing leaves similar to the mountain spikenard *(Valeriana tuberosa)* which are divided into five leaflets of which some are sinuated. The flower stalks which are nine inches long are slender and smooth and the flowers pale red and stellate." The figures accompanying this description (plate 14) are easily recognized as a form of our well-known dahlia, although the plant had to wait 175 years for a permanent name. Hernandez called his three forms by their Aztec names, Acocotli, Cocoxochitl, and Acocoxochitl. Cocotli meant tube or hollow stem, and the

native names may be translated as "Water pipe," "hollow-stem flower", and "water-pipe flower", respectively.

It is generally believed, in fact all the earlier accounts state, that the credit should be given to horticulturists for producing the great variety of color and form now known in the dahlia. While it is true that by hybridizing and selection much has been done in this direction, the fact is that Hernandez specifically states that there were many forms of Acocoxochitl occurring in Mexico. These differed from one another in size and color, "some white, others yellow, others purple or perhaps yellow tinged with purple, and a great many other kinds, in some cases with double or multiple whorls of ray flowers, either forming circles or clustered in compact masses."

In a work published at Rome in 1651 by Vitalis Mascardi there is a figure of a double-flowered dahlia which has until recently been regarded as an evidence that at this early date cultivation by florists had resulted in this change from the single to the double type. No further record of the plant is to be found until 1787, when a Frenchman, Nicholas Joseph Thiery de Menonville, was sent to America for the cochineal bug. He speaks of dahlias seen in a garden near Guaxaca which had large aster-like flowers, stems as tall as a man, and "leaves like those of the elder tree."

Although the credit is usually given to Humboldt, the introduction of the dahlia into Europe is undoubtedly due to the Marchioness of Bute, whose husband was ambassador from England at the Court of Spain. In 1789 the director of the botanical garden at Mexico sent seed to the Royal Gardens at Madrid. The Marchioness obtained some of these seed and cultivated the plants in her English greenhouse. While not particularly successful (probably because anything from Mexico in those days was supposed to require tropical heat), she disseminated seed to various correspondents, including most of the botanical gardens in Europe. By 1803, an English nurseryman, John Fraser of Sloane Square, had flowered *Dahlia coccinea* (a single form) in his greenhouse, and this plant was the subject of the first picture to be printed in England, appearing in the "Botanical Magazine" in 1804

DAHLIA COCCINEA: FIRST FIGURE OF THE DAHLIA PRINTED IN ENGLAND. BOTANICAL MAGAZINE, PL. 762, 1804

"Our drawing was taken in June, 1803, at Mr. Fraser's of Sloane Square who has the credit of introducing this ornamental plant amongst us from France."

Fig. 68.—Dahlia Yuarezii: Crimson. (See p. 433.)

DAHLIA YUAREZII: CRIMSON. GARDENERS' CHRONICLE, OCT. 4, 1879, p. 433

"The dahlia was obtained from Mr. Cullingford of Phillimore Gardens, who received it from Messrs. Ant. Roozen & Son of Overneen near Haarlem. On application to the latter gentleman we learn that they derived it some few years since from a French nurseryman, and suppose it to have been imported from Mexico."

(plate 15). In 1804 Lady Holland, who was then in Madrid, sent home seed from which plants were raised and bloomed at Holland House, Kensington. These plants were later lost. They were probably pink or red when they were in flower, for Lord Holland wrote to his wife as follows:

"The dahlia you brought to our isle
Your praises for ever shall speak,
Mid gardens as sweet as your smile
And in color as bright as your cheek."

The director of the Madrid garden, Abbé Cavanilles, named the plant, seed of which was sent from Mexico, in honor of André Dahl, a Swedish botanist, and thus the pronunciation "dah-li-a" heard in America is correct, and not "day-li-a" which one hears so frequently in England. It should be noted that for a short time the name dahlia had a competitor in the name "Georgina" given one year later to the same plant by Willdenow in honor of Professor Georgi of St. Petersburg. This name persisted in England as late as 1832, possibly because it was mistakenly supposed to exalt George III.

Cavanilles recognized two species, *Dahlia pinnata* and *D. coccinea*. The seedlings from *D. pinnata* were so various that it was renamed *D. variabilis*, but according to the rules of nomenclature the latter name cannot stand. The same can be said of *D. rosea*, which is simply a synonym of *D. pinnata*. The many varieties of dahlias with rounded compact heads, looking so artificial, are descended from this species. *D. coccinea* does not cross with other species and retains the simple habit. The color varies from scarlet to yellow or brownish red, never verging on pink or crimson.

While the question of the number of true species of Dahlia need not be discussed here, there is one other species which is of interest in tracing the origin of some of the newer forms. About 1863 there was sent to Europe from some unknown locality in Mexico a single hybrid plant growing in cultivation, afterwards named *Dahlia juarezii*, which was the origin of all the varieties now known as cactus dahlias or hybrid cactus dahlias. It bloomed for the first time in 1864 and was figured in the "Gardeners' Chronicle" in 1879 (plate 16). It was not until October 21, 1916, however, that the ancestral

wild form of *D. juarezii* was discovered by Wilson Popenoe in Guatemala. This proved to have a single row of eight long spreading crimson rays turning backward along the margin, and was named by Safford *D. popenovii.*

But to return to the earlier history of the dahlia. For ten years after the publication of the dahlia in the "Botanical Magazine" the plant was grown more and more extensively, the effort of the dealers being to improve the colors and particularly to produce double flowers. The quality of the dahlia to vary indefinitely was soon recognized, and growers throughout Europe were active in their experiments. Donkelaar, of the Botanical Garden at Louvain, was particularly successful, and to him is due the credit of making the dahlia fashionable and establishing it as a flower worthy of cultivation.

By 1814 the dahlia was established in England and France, and Erfurt and Leipzig, in Germany, and The Hague, in Holland, were noted centers for its cultivation. Amateurs were exchanging seed and tubers, and for nearly fifty years this plant was to be the talk of the horticultural world. It became the favorite exhibition flower, and the mild excitement occasionally manifested at the present day over a new rose or a promising perennial is as nothing compared to the frenzy which prevailed over the dahlia seventy-five years ago. The "Annual Dahlia Register," one of the first publications of its kind, appeared in 1836, and we find it filled with advertisements of dealers in dahlias, the prices per plant ranging from five to twenty-one shillings. George Glenny, of Isleworth, advertises that he "selects from upwards of 3000 double-flowered varieties."

According to Robert Hogg ("The Dahlia, its History and Cultivation. With colored plates from original drawings by James Andrews," London, 1853), the characters of a first-rate dahlia seventy-five years ago were as follows:

"1.—*Form of the flower.* This is the most important feature. If the form is deficient in any particular, colour and size, however perfect, cannot render compensation. A perfect flower should present in appearance, when looked down upon, that of a perfect circle; and when looked at sideways it should resemble about two-thirds of a globe with centre well filled up with petals. The flower should be very double, every side equally filled with petals,

which should be placed alternately so that each will cover the opening which exists below it in the lower tier.

"2.—*Colour of the flower.* If the flower is a *self* it should be bright and clear, distinct and constant. Each petal from the lowest to the centre should be of the same shade of colour without shading or spotting. Those flowers which are *striped* should have the markings well defined and should not run into the body colour. Each stripe should extend to the bottom of the petal, or at least out of sight. *Edged flowers* should have the colour on the edge of the petals as distinct as possible from the body colour. In *tipped flowers* the colour on the tip of the petal should be very distinct from that of the remaining portion and clearly and cleanly separated from it. *Fancy dahlias* are those which have the stripes, edges, tips, or spots of a colour lighter than the body colour.

"3.—*Size of the flower.* This is also a character to which florists attach considerable importance. There are many very excellent flowers raised which are afterwards discarded from being wanting in this respect, although they may possess all the other desiderata in an eminent degree. The standard which is now adopted is, that no flower should be less than four, and not greater than six inches in diameter."

From about 1860 the popularity of the dahlia began to decline, but with the organization of the National Dahlia Society of England in 1870, there was a temporary revival of interest. At no time, however, was there a lack of growers, both amateur and commercial, who continued to work for improvement. In the early days single varieties were inadmissable at shows and the cactus group was of course unknown. However, in spite of these limitations cultivators of dahlias all over Europe kept steadily at it, and we are today enjoying the results of their efforts.

As we now know, double forms of the dahlia were well known to the Aztecs who domesticated the wild dahlias of the mountains of Mexico and Guatemala before the discovery of America. It was not until 1814, however, that a double variety was obtained by Donkelaar at Louvain, and as has been said, it is generally believed that the double dahlia is the result of modern selection and cultivation.

The spotted or mottled varieties were early regarded as more desirable than the self-colored ones. But these forms were the hardest to fix, and it was only by repeated propagations that they could be kept true to type. The propensity of the dahlia to "throw sports" was one of the first character-

istics to be recognized, and it was undoubtedly this fact which induced many growers to keep experimenting. While one could not predict what would come in the next generation, it was almost certain to be something different. For instance, the variety "John Sladden" obtained from "Dandy" was rose-pink striped with dark maroon shading into almost black. In one generation this form gave in addition to the characteristic shading solid black and solid pink flowers. The black remained true to type, but the pink again varied, throwing in the second generation a white-flowered form. Thus from one variety within six years there were obtained: black; pink and maroon striped; pink; and white—all four of which were fixed and received new names.

The original wild species, *D. pinnata*, gave rise to the so-called "show" or ball-shaped formal flowers. From this there was developed in France the "fancy" type. The "cactus" dahlia was introduced into Holland through a shipment from Mexico. A few seed produced what we now know as *D. juarezii*, to which reference has already been made. The first exhibition of the "cactus" type was by Swanley at London in 1879.

The "decorative" dahlia is believed to be the result of a cross between the "show" and "cactus" varieties, differing chiefly from the typical "cactus" in its strength and more profuse blooming. The "pompon" or "bouquet" type is of German origin, dating back to 1808, when Hartwig obtained it from the single-flowered *D. coccinea*. It was in high favor for a while because of the small flowers which could be used in bouquets.

So much time and effort had been devoted to redeveloping the double varieties of dahlias in the Old World that the single varieties were completely ignored and almost forgotten until 1880. Slater exhibited the single *D. coccinea* at a Royal Horticultural Society show in that year, and immediately as much interest was aroused in the single forms as if they were something new. The same thing is now happening with respect to the dwarf dahlias, supposed to be quite recently developed and only beginning to be used as a bedding plant. Yet the so-called "Tom Thumb" form, a race bearing single

flowers and ranging in height from nine to twelve inches was developed in England over thirty years ago. Dwarf or bedding dahlias have been known in America for a least seventy years. Here we have another example of the great variability of the dahlia manifested not only in the shape and color of the flowers but in the size of the plant which may range in different varieties from nine inches to ten feet.

The Dahlia in America.—It is extremely difficult to trace correctly the introduction and development of the dahlia in America. Apparently, however, it was not many years after the culture of this plant was established in England that a few growers on the Atlantic coast began to experiment with it. The first book and probably one of the very first publications on the dahlia in the United States was by E. Sayers. This was printed in Boston in 1839 under the title "Treatise on the Culture of the Dahlia and Cactus." The little book contains but seventy-two pages 4x2½ inches, of which the first forty-five are devoted to the Dahlia, and we are indebted to Sayers for all the information we have concerning the early interest in this flower in the United States. Since the book is almost forgotten and the one in the Garden library is one of the very few copies extant, the following quotation will be of interest:

"Having spoken of the introduction and encouragement given to the Dahlia in Europe, it now becomes my duty to give a cursory view of the encouragement it has met in this country, for certain it is that in this part of floriculture America keeps a closer pace with Europe, than in the culture of any other class of florist's flowers. It is only within ten or twelve years that any fine specimens of Dahlias were to be seen in this neighborhood, nor I believe in any other parts of the States; the *D. coccinea speciosissima* I recollect to be first grown by Mr. William Leathe, of Cambridgeport, near Boston, about ten years ago; it attracted much admiration, and at that time was considered a very elegant flower; it was however soon eclipsed by that splendid scarlet, the Countess of Liverpool, and a general improvement made rapid strides in the self colors, until the parti-colored flowers made their appearance and formed a new era in the list of choice Dahlias. It would be altogether needless for me to name over the many splendid varieties now extant; suffice it to say that almost every variety of shade and color, as well as the greatest perfection of form, is now to be seen in the Dahlia. There is much credit due to certain individuals who have been at pains to introduce new and rare kinds into this

country, as they have made their appearance in Europe. Through their laudable efforts the lovers of the Dahlia have been put in possession of choice kinds with comparatively little trouble, a correspondence having been kept up by these public spirited individuals with Widnal and the most noted growers in England and other distant countries.

"No person has done more for the introduction and advancement of the culture of the Dahlia than George C. Thorburn, of New York, who yearly flowers many thousand plants at his place at Hallet's Cove, near Harlaem. The show there in the flowering season is a rich treat for the lovers of floriculture: for almost every variety can be seen growing in two large blocks or masses which lead from the road to the dwelling-house, and form a complete field of the Dahlia as a foreground to the house.

"Mr. T. Hogg, Mr. William Read, and many other well-known florists, have also contributed much in the vicinity of New York, to the introduction of the Dahlia. Indeed so general has become the taste that almost every garden has its show of the Dahlia in the season. In Boston too, there are many choice collections, and there exists a rivalship among the amateurs which is a sure prelude to perfection in floriculture. In the vicinity, the Messrs. Hovey, of Cambridgeport, have bestowed much pains in collecting yearly the choice kinds from every source where they could be obtained; their collection is well chosen, and the interest they take to show their flowers in the flowering season entitles them to the public patronage. The lovers of flowers cannot but be sensible that a free privilege to view such collections as those, should be requited by liberal purchases of the plants, thus encouraging and aiding the grower to carry the culture to the highest point. In the vicinity of Cambridge, Mr. Samuel Sweetser's collection is also amongst the best in the Union; Mr. William Leathe, of that place, with Mr. McIntire, have well chosen collections; and indeed it might be said that the *Port* is almost unrivalled for amateurs in florist's flowers. Many more amateurs might be quoted in this neighborhood who have much contributed to the culture of the Dahlia, would my limited space allow."

For the next fifty years after Sayers' book practically nothing of any importance appeared on the dahlia in this country. It is true that in Volume 2 of "American Agriculture," 1843, there appeared a brief note, with a picture, giving directions for propagation, and a statement is made that "We found the dahlia usually of a larger growth in England than in our own country." In 1853 the "Country Gentleman" published a list, with descriptions, of the best new dahlias in England "From a source upon which we can place reliance." Seedsmen's catalogues about 1860 began to

publish lists of dahlias, at first dividing them into "First class at $4 a dozen," and "Second class at $2.50 a dozen." B. K. Bliss of Springfield, Mass., in his fourth annual catalogue, 1860, recognized four classes, as follows:

Class 1, divided into English varieties, 20 in number, and Continental varieties, 17 in number.

Class 2, best varieties of 1858, 33 in number.

Class 3, best varieties of 1857 and previous years, 197 in number.

Class 4, dwarf or bedding dahlias, 9 in number.

Dreer's "Garden Calendar," which of course was his catalogue, for 1875 lists the dahlias of "Mr. Gerhard Schmitz, the successful dahlia grower of Philadelphia whose years of experience justify the originator in pronouncing these the best he has ever sent out." In addition to Schmitz's new prize dahlias, Dreer lists new foreign large-flowering varieties, new foreign Lilliputian varieties, Lilliputian or bouquet dahlias, and fancy varieties, the latter being arranged in the colors, purple and lilac, yellow, scarlet, maroon and crimson, and white.

By 1890 seedsmen began issuing separate catalogues of dahlias, and the modern classification of cactus, pompon, show, fancy, etc., was adopted. Certain dealers now styled themselves "dahlia specialists," and "Garden and Forest," "Florists Exchange," and other horticultural magazines began to devote more and more attention to the best types of dahlias.

After Sayers' book no comprehensive treatise on the dahlia was printed in this country until 1896. This was a paper-backed pamphlet of sixty-four pages by Lawrence K. Peacock. It was called simply "The Dahlia" and cost fifty cents. Every aspect of the subject is discussed, and except for the lists of varieties and certain other matter now out of date, it is as valuable as the year it was printed. For the first time there was available an American work, prepared by a grower with years of practical experience. Apparently there were at least two editions of this pamphlet, although there is no indication of this fact on the title-page or elsewhere on

the two copies in the Garden library. Both are dated 1896 but they differ materially in illustrations and lists of varieties.

The first American Dahlia Society, which is not to be confused with the existing American Dahlia Society, founded in 1916, was organized at the Hotel Hanover, Philadelphia, March 20, 1895. This society announced its intention to classify all existing varieties and make a meritorious list of all dahlias scoring a given number of points. It also was to assist "the promotion of local societies in every floral community for the purpose of holding local exhibitions during the summer and autumn months. At the first regular stated annual meeting, held October 9, 1895, the following officers were elected for the ensuing year: Robert Kift, Philadelphia, President; Henry F. Mitchell, Philadelphia, Vice-President; Lawrence K. Peacock, Atco, N. J., Secretary; E. Clifton Taylor, Germantown, Pa., Assistant Secretary; Frank C. Brunton, Philadelphia, Treasurer; and A. Blanc, Philadelphia, Chairman of the Executive Committee.

In September, 1896, the Society proposed to give "such a comprehensive show as was never seen before." This was held, and "The Public Ledger," under date of September 23, 1896, says, in part:

"The Dahlia show in St. George's Hall, at Thirteenth and Arch Streets, has exceeded expectations as an attraction and in the qualities of the flower for exhibition purposes. Those who knew the Dahlia had faith in it, but others were afraid it might not show up well by gas light, and would thus prove worthless both for the exhibition table and for decorative purposes. Last night was the test, and the result was satisfactory beyond anticipation. The flower was indeed improved by the artificial light; the velvety texture of the petals serving to deepen the hues of the darker shades and to increase the delicacy of the lighter. The exhibit, beautiful by daylight, was fairly radiant at the evening show.

"The Dahlia has all of the colors but blue and all of the shades and hues of the transition from one to another. It is, too, as variable in size and shape and form as in color. There is no monotony in a Dahlia show. The same variety in the hands of two different growers will sometimes seem almost distinct."

The next year the second show was held on September 21-22, under the auspices of the Pennsylvania Horticultural Society at their new hall on "Broad St. below Locust." In 1898 the

American Dahlia Society held its annual exhibition in connection with the sixty-seventh fair of the American Institute of the City of New York, at the Academy of Design. Money prizes were offered by the Society, competition for which was open to all. But "non-members of the Society winning one or more prizes will be assessed $1 for annual membership." The schedule for these shows was divided into commercial and amateur classes and included the following classifications in varying numbers and colors of flowers: cactus, including decorative, show, fancy, pompons, and singles.

NOTABLE ST. LOUIS GARDENS

V. The Garden of Mr. and Mrs. Hermann von Schrenk

The von Schrenk's garden is located at Florissant, which in the French tongue, means "blooming" and was originally applied to the St. Ferdinand valley because of the fertility of its prairie soil. As its name might indicate, the town has an interesting history dating back to French and Spanish times. In fact, the foundations of the von Schrenk's home were laid by the old Spanish governor, Alarez, in 1792, and it is in his memory that they have named their estate Casa Alarez.

Though the deep prairie loam of the Florissant valley is enough to make any gardener's heart rejoice, the same cannot be said for the hot, drying winds which sweep across in spring and summer. In such a location a good windbreak is the first essential for a fine garden, and at Casa Alarez the wind has been shut out by a thick screen of evergreens and maples. However, the trees at Casa Alarez are more than a mere windbreak, for the von Schrenks have been particularly interested in evergreens, or conifers, to be more precise, and have assembled a really notable collection. Many of them have been obtained from nurseries, but some of the rarer specimens have been collected by the von Schrenks themselves. Among the latter is a thriving specimen of Colorado red cedar, *Juniperus scopulorum* Sarg., which Dr. von Schrenk dug up in the Teton Mountains, east of Yellowstone Park. In the collection

at Casa Alarez there are conifers from many different parts of the world growing side by side. A particularly interesting group of this sort is formed by the Aztec pine, *Pinus Ayacahuite* Ehrenb., our common white pine, *Pinus Strobus* L., the Himalayan white pine, *Pinus excelsa* Wall., and the bald cypress, *Taxodium distichum* Rich. One could hardly pick four more diverse and widely separated regions than are represented by the native homes of these four species, the cool pine forests of eastern North America, the dry mountain canyons of southern Mexico, the humid cypress swamps of the Gulf coast, and the high mountain valleys of the Himalayas; yet at Casa Alarez the four grow side by side, each a splendid specimen.

Having had so much experience with conifers, the von Schrenks naturally have many valuable suggestions for those St. Louis gardeners who are fortunate enough to live outside the smoke zone. They have found that the quickest-growing pines are the common white pine, *Pinus Strobus* L., and the Austrian pine, *Pinus nigra* Arnold. The latter is less graceful but is generally more smoke-resistant, and for that reason is to be particularly recommended for suburban planting. None of the southern pines have proved hardy, and even the southern yellow pine, *Pinus echinata* Mill., which grows naturally just a few miles south and west of St. Louis, has been winter-killed every time it has been planted there. However, it may be the non-acid soil of the Florissant valley that really kills the tree and not the lower temperatures. The Japanese red pine, *Pinus densiflora* Sieb. and Zucc., has done well, though it has lost its leaves in every bad sleet storm.

Of the firs (Abies), only the western silver fir, *Abies concolor* Lindl. & Gord., and the European silver fir, *Abies pectinata* DC., have succeeded. All of the junipers have done well and are to be generally recommended for St. Louis gardens outside the smoke zone. Their only serious enemy is the bag worm which is easily controlled by a spray of arsenate of lead.

The statement that these various conifers have done well at Casa Alarez does not imply that they have not required care and attention, particularly during the first few years. Getting evergreens established in this climate is an art. In

CASA ALAREZ, SHOWING CONIFERS IN BACKGROUND.

PERENNIAL GARDEN AT CASA ALAREZ

the following planting directions, Dr. von Schrenk has summarized his experience for the benefit of other gardeners in this locality:

Use specimens not over four feet in height, "balled and burlapped" at the nursery. Leave the burlap on the roots when planting. Plant in the early spring, by the middle of March. Dig a generous hole for the tree, eight or ten inches larger each way than the balled roots. Fill in with ordinary loam but do not tramp down the soil. Use the garden hose and wash the soil into place. After a day or two, when the soil has settled down, untie the cords which hold the ends of the burlap about the base of the trunk. Mulch the surface well with straw or leaves. Water generously throughout the first summer—at least one good watering a week. When watering arrange the mulch in a bowl-shaped ridge to help hold the water.

While the outstanding feature of the von Schrenk garden is its evergreen collection, the perennial garden is probably of more general interest. Few St. Louis gardeners have reached the point where they appreciate rare conifers, but nearly all have progressed to the perennial stage. The von Schrenks feel that the success of their perennial garden is due to mulching, and they practice what they preach in using mulches liberally. For making the mulch, maple leaves are gathered every fall and stored in large wooden bins. (Every third tree in Florissant is a silver maple so there is an almost inexhaustible supply of maple leaves.) By spring these will have begun to decay, and part of them are used to cover the perennial garden with a mulch blanket. The perennials are allowed to come up through the mulch, thus saving a good deal of weeding as well as conserving moisture. During the summer another mulch is applied. For this the mulch left over from the spring of the previous year is used. Thus, the leaves collected in the fall of 1927 were used as a spring mulch in 1928, and as a summer mulch in 1929, by which time they will have become a fine black leaf mold. Used in this way, mulches enrich the soil and conserve the moisture to such an extent that very little watering is necessary.

From among the many perennials which have been grown at Casa Alarez, the following have proved the most depend-

able and are particularly to be recommended for St. Louis gardens:

Anchusa myosotidiflora, Perennial forget-me-not.
Aster tataricus, Tartarian aster.
Baptisia australis, False indigo.
Bocconia cordata, Plume poppy.
Boltonia asteroides, False chamomile.
Campanula glomerata, Clustered bellflower.
Gypsophila paniculata, Baby's breath.
Linum, Flax (red and blue varieties).
Polemonium reptans, Greek Valerian.
Thalictrum adiantifolium—Maidenhair meadowrue.
Valeriana officinalis, Garden heliotrope.
Veronica, Speedwell (all the low varieties).

One little-known perennial which the von Schrenks like very much and has done very well with them is the perennial forget-me-not, *Anchusa myosotidiflora*. As its scientific name indicates, it is really an Anchusa, but resembles the true forget-me-not in general effect.

NOTES

Dr. Roland V. La Garde, Research Assistant to the Garden, spent two weeks during August in northern Minnesota, collecting algae.

Mr. Paul A. Kohl, Floriculturist to the Garden, gave an illustrated lecture before the St. Louis Horticultural Society, August 2, on "Iris and Iris Diseases."

Mr. L. P. Jensen, Arboriculturist to the Garden, acted as judge at the flower show given by the Associated Garden Clubs of Kirkwood, Mo., at the Kirkwood High School.

Dr. J. M. Greenman, Curator of the Herbarium, attended the western meetings of the Botanical Society of America, at the University of Wyoming, Laramie, Wyoming, July 31-August 4, and was chairman of the taxonomic section.

Among the organizations visiting the Gray Summit Extension during the summer were the South Kirkwood Garden Club, June 14, the St. Louis Association of Gardeners, June 16, and the St. Louis Horticultural Society, June 30.

Visitors to the Garden during the summer months include the following: Dr. R. D. Rands, pathologist, Office of Sugar Plant Investigations, U. S. Department of Agriculture; Dr. E. E. Sherff, Instructor in Botany, Chicago Normal College; Mr. Dale Chapman, graduate student in botany, University of Wisconsin.

Some of the moving picture films showing activities of plants, particularly those under the microscope, were shown at Woods Hole, Mass., during the visit of the delegates to the International Physiological Congress. Dr. Moore, Director of the Garden, explained the films to the visiting delegates.

Mr. L. P. Jensen, Aboriculturist to the Garden, has given the following talks recently: June 7, before the St. Louis Horticultural Society, on "Growing Trees and Shrubs from Seeds"; June 14, before the South Kirkwood Garden Club, "Wild Flowers"; July 1, before the Garden Club of Gray Summit, Mo., "The Gray Summit Extension"; July 7, radio talk over Station KMOX, "Wild Flowers of the Ozarks and Their Conservation"; August 4, before the Garden Club of Gray Summit, "Transplanting of Woody Plants."

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1929

GARDEN ATTENDANCE:

Total number of visitors in June	35,614
Total number of visitors in July	32,817
Total number of visitors in August	43,869

PLANT ACCESSIONS:

Total number of packets of seeds donated in June	13
Total number of packets of seeds donated in July	19
Total number of packets of seeds donated in August	70

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	57
Total number of books and pamphlets donated in June	119
Total number of books and pamphlets bought in July	44
Total number of books and pamphlets donated in July	236
Total number of books and pamphlets bought in August	29
Total number of books and pamphlets donated in August	79

HERBARIUM ACCESSIONS:

JUNE

By Purchase—

Broadway, W. E.—Plants of Trinidad and Tobago	100
Montero, O. Prof. G.—Plants of Chile	52

By Gift—

Anderson, Dr. E.—Plants of Kansas, North Carolina, etc.	44
Beecroft, W. I.—Plant of Nevada	1
Drushel, Prof. J. A.—Plants of Texas	4
Jeffs, Prof. R. E.—*Streptanthus maculatus* Nutt. from Oklahoma	1
Kellogg, John H.—Plants of Missouri	2
Kiltz, B. F.—*Coronilla varia* L. from Oklahoma	3
Pring, G. H.—*Syringa amurensis* Rupr. from horticulture	1
Total	208

JULY

By Purchase—

Jones, Prof. Marcus E.—Plants of Mexico	946
Venturi, Prof. S.—Plants of Argentina	531

By Gift—

Denniston, Prof. R. H.—*Acer saccharum* Marsh. from Kentucky	1

Hunt, Benjamin W.—*Phoenix rupicola* T. Anders. from horticulture 1
Johnson, Harry P.—*Ficus* sp. from horticulture..... 1
Osborn, Mr. Ben—*Senecio plattensis* Nutt. from Oklahoma 3
Reed, Prof. E. L.—*Pseudoclappia arenaria* from Texas.... 1
Stratton, Prof. Robert—*Centaurea picris* Pall. from Oklahoma 1

By Exchange—

Demaree, Prof. Delzie—Plants of Arkansas..... 200
Overholts, Prof. L. O.—Plants of Ohio, Colorado, etc..... 125

By Field Work—

Mathias, Miss Mildred—Plants of Western United States.. 430

By Transfer—

Tropical Station, Missouri Botanical Garden—Orchids collected by C. W. Powell 265

Total 2,505

AUGUST

By Purchase—

Broadway, W. E.—Plants of Trinidad and Tobago..... 100
Jörgensen, Pedro—Plants of Paraguay..... 874

By Gift—

Crippen, Lloyd C.—*Achimenes grandiflora* DC. from horticulture 1
Harris, Mrs. W. John—*Campanula americana* L. from St. Louis County, Missouri..... 1
Lawrence, Miss Julia R.—Plants of Wisconsin..... 5
Reed, Prof. E. L.—*Sida lepidota* Gray from Texas..... 1
Stevens, Miss Mary—Plants of Pennsylvania..... 152
Wild, C. M.—*Helianthus multiflorus* Hort. from Missouri 1

By Field Work—

Greenman, Dr. J. M.—Plants of Wyoming..... 315

Total 1,450

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1929

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

Vol. XVII OCTOBER, 1929 No. 8

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FRUITING CASTOR-OIL PLANT.

Missouri Botanical Garden Bulletin

Vol. XVII OCTOBER, 1929 No. 8

THE FEEDING OF SHADE AND ORNAMENTAL TREES

Volumes galore have been written about fertilizers of all sorts and their effects upon farm crops, vegetables, and flowering plants. Innumerable experiments carried on over extended periods of time have furnished the information on which modern fertilizing practices are based. Yet strangely enough, practically nothing of value is known concerning the proper method of feeding ornamental or shade trees. This is the more remarkable since such detailed and lengthy discussion has been devoted to the kind of tree for particular locations, spacing, depth and time of planting, nature of soil, pruning, spraying, general care, in fact everything but feeding. It is true that considerable attention has been paid to the fertilization of orchards, many state experiment stations having attacked the problem from various standpoints. However, in spite of this fact, the evidence is so conflicting, and in some cases the results so untrustworthy, that one authority on the subject does not hesitate to say that "all orchard fertilizer experiments heretofore conducted are subject to a large probable error and should be discounted accordingly." Indeed a majority of the tests carried out in a dozen different states would seem to indicate that many of the orchards failed to respond to the use of any kind of fertilizer. At best, the use of commercial fertilizers on orchard trees seems to be regarded by many as only a substitute for cultivation, although some quickly available form of nitrogen has been recommended as a tonic for starved or sickly trees.

Is the same thing true for evergreens, oaks, elms, sycamores, maples, and other common trees used for shade or ornament either along streets or on lawns? Can such trees which usually grow in localities not subject to cultivation be benefited by feeding? If so, what fertilizer should be used? What time of year is its use most beneficial? In what quantity and how often must it be applied? These are some of the questions asked by those who have one or more trees showing signs of distress and who wish to do everything possible to save them.

In order to obtain as definite an answer as possible to these and other questions the Garden undertook a year ago a series of experiments on various trees, calculated to throw light upon the whole matter of tree feeding. As these trials cannot be completed for some time, probably a number of years, it is thought advisable to bring together all available information in order that those having need of such facts may experiment for themselves. Accordingly, a rather thorough search of the literature on the subject has been made, and the results are given here for what they are worth.

In Europe, particularly in Germany, the majority of the work has been done in connection with reforestation, and most of the data refer to seedlings, chiefly conifers. In spite of the fact that young trees are more apt to show the immediate effect of fertilizers, and large numbers can be used in the experiment, the results have not been very satisfactory. For instance, Hornberger (6), working with pine seedlings in experimental beds of 100 square meters and applying at varying times varying quantities of kainite, Thomas phosphate, Chile saltpetre and lime, after five years was unable to draw any conclusions. Schwappach (12) carried on experiments with forest trees (firs) in Belgium. His results may be briefly summarized as follows: For young fir seedlings nitrogenous fertilizers only were effective. The best results were obtained with green manure (lupins), since the nitrogen was continuously though slowly available. With trees six years old, lime, Thomas slag, and kainite were either unfavorable or produced no result. In one experiment, however, where these fertilizers were used, plus Chile saltpetre, the six-year-old fir trees showed a remarkable increase in growth and

greater resistance to fungous disease *(Hysterium Pinastri)*. A photograph of this experiment was exhibited at the Louisiana Purchase Exposition, at St. Louis, in 1904.

The same author (13) reports on experiments on fertilizing forest trees in different parts of Prussia and concludes:

1. The use of Chile saltpetre on alluvial sandy soils is useless, since it is washed away before it can be utilized.
2. The soils contained so much potassium that adding kainite was useless.
3. The soils contained about 0.5 per cent of phosphoric acid which was sufficient, and the addition of phosphates was useless.
4. A favorable effect was produced through the addition of nitrogen from green manure (lupins).

On the other hand, Clausen (2), studying the effect of different fertilizers on hemlock, believed that ammonium sulphate increased growth and improved color, that lime (calcium carbonate) had a favorable effect in all cases where applied to uncultivated soils, that Thomas slag had a very favorable effect, and kainite was beneficial on light soils. Moeller (8) carried on extended experiments with dry peat as a fertilizer. Working with fir seedlings on poor sandy soil in 29 different parts of Germany, he came to the conclusion that dry peat as a fertilizer was superior to any combination of chemicals. Similar results were obtained with pine, hemlock, and larch. He makes the interesting observation that the growth of the main stem depends upon the nutritive condition of the previous year, while the length, thickness, and color of the leaves depend upon the nutritive condition of the current year.

Vater (16), discussing the nutrition of forest trees, concludes that experiments prove that fir and pine seedlings prefer ammonium sulphate to Chile saltpetre as a source of nitrogen, while the reverse is true for the beech tree.

And so one might go on quoting indefinitely. It is needless to say that the above references are given not to furnish any practical information concerning the feeding of trees but rather to emphasize the lack of definite information which can be applied to our local conditions.

Perhaps one other foreign investigator should be referred to, since he emphasizes that not only the kind and quantity of fertilizer are important but the time of application should be taken into consideration. Ramann (11) if he could be depended upon for a final answer, would be most satisfactory. Certainly he gives information in a form calculated to be most useful. According to him, the different trees with which he worked should have fertilizers applied at the times indicated below:

	February to middle of May	Middle of May to middle of July	Middle of July to middle of September	Middle of September to middle of November
Nitrogen Green manure (legumes best). Stable manure or compost with peat	Hemlock Oak	Pine Beech Fir Oak	Fir Larch Beech Pine Oak	Larch Fir
Potassium Any potassium salt. Dose 400 kgm. to hectare	Hemlock	Pine Fir	Larch Fir Hemlock Pine	Hemlock Pine
Phosphates Thomas slag, or any phosphate containing lime. Dose 1600-2000 kgm. to hectare	Hemlock	Pine Hemlock	Fir Pine	Larch
Calcium Not necessary if phosphates containing lime are added. Should be applied carefully in small quantities				

Turning now to published accounts in this country on the feeding of trees, one finds more or less the same situation as exhibited in the quotations from foreign writers. In general, it may be stated that while the information circulated in America may appear to be more definite, this is due in part at least to the lack of actual experiments from which conclusions can be drawn. In other words, it is easy to be exact if one is not compelled to fit conclusions to a series of results obtained by experiments. More frequently, however, the entire subject is ignored. For instance, a bulletin from one of the well-known colleges of agriculture on "Street Trees, their Care and Preservation," makes no mention of the use of fertilizers. Various sources of injury and the protection and pruning of trees are fully discussed, but nothing about feeding. Another experiment station bulletin on "Shade Trees" devotes 139 pages to the characteristics, diseases, care, etc., of these trees and about one page to fertilizers. The following quotations are interesting:

> "Any good complete fertilizers *(sic.)*, such as those adapted to lawns, should prove valuable for trees.
>
> "A certain amount of nitrate of soda at the rate of 150 to 200 pounds per acre, may be used to good advantage, but care should always be taken not to apply it too freely.
>
> "Stable manure well incorporated into the soil at the rate of 20 to 30 cords per acre is of the greatest benefit to the tree.
>
> "There are a number of fertilizer mixtures prepared for shade trees that are undoubtedly of value, but some of them are apparently not based on any expert knowledge of the tree's special requirements."

All of which only emphasizes the lack of accurate knowledge on the requirements of ornamental trees under city conditions.

In spite of the unsatisfactory situation concerning the artificial feeding of trees, certain authors have been brave enough to make definite recommendations. While in most cases the evidence for the recommendation is lacking and one is compelled to accept the suggestion as merely tentative, it does furnish a starting point for experimentation and under certain conditions would undoubtedly prove valuable.

In a Farmers' Bulletin of the U. S. Department of Agricul-

ture, Mulford (9) advises the use of nitrate of soda (Chile saltpetre) at the rate of ½ to 1 pound in 50 gallons of water. From 1 to 25 gallons of this solution should be applied, depending upon the size of the tree. An important point is the time of application. If applied when the tree is dormant the fertilizer will leach from the soil before it can be absorbed by the roots. If applied late in the season (within three months of freezing weather) late growth would be stimulated which would be killed in the following winter and possibly make the whole tree more susceptible to cold. Consequently the solution should be applied early in the season when the tree is in active growth.

In a leaflet issued by the Park Department of Dallas, Texas, Charlton (1), the city forester, devotes an unusual amount of space to the feeding of "starving trees". After calling attention to the value of humus in the soil which may be supplied by the liberal use of manure and leaves, he says: "Commercial fertilizers may be used separately or in combination as complete fertilizers or balanced rations. Trees need phosphates, nitrates, and potash. Not every soil, however, needs the addition of all three. Every seed store has one or more of these complete fertilizers prepared for lawns, or, perhaps, for trees. Doubtless every one of them is valuable as a fertilizer for a tree."

This is not very satisfactory but he becomes more specific and consequently more helpful in the following statements:

> "As emergency rations, two concentrated fertilizers are available, sodium nitrate and ammonium sulphate. What is here said of the nitrate applies to the sulphate.
>
> "Apparently there are two periods when nitrate can be used with young trees and trees in distress: 1. In early spring as the new season's growth starts. 2. Promptly during dry weather before the trees suffer for water.
>
> "The nitrate can be used as here indicated. For each inch in diameter of the tree up to 5 inches, ½ to 1 pound. For larger trees up to 10 inches, 2 pounds per inch may be used. The larger the tree the greater the space over which to scatter the nitrate. Always as far as the roots extend, at least beneath entire spread of top. Without fail, add great quantities of water, 20 gallons per pound of nitrate, the more the better. Use digging fork to help it sink to deep roots.
>
> "Repeat heavy watering twice within a week and then once

per week for a month. After 3 or 4 weeks this use of nitrate may be repeated, but not later than August 10th [for Dallas] lest new tender growths be started which an early frost may kill."

Another formula for the use of nitrate of soda is given by Pack (10): "If the nitrate of soda is applied separately ¼ to ½ oz. per tree may be used. Nitrate of soda is a strong plant stimulant so needs to be used in small quantities at any one time but can be used more frequently." Pack further recommends as a good mixture for most trees in light soil "equal proportions of nitrate of soda, acid phosphate, muriate of potash and ground bone. This should be applied in spring with the exception of nitrate of soda which should be applied only when roots are active. The amount required for the individual tree will be from 1¼ to 2 ounces of the mixture for a tree occupying a space of 8 square feet."

For heavier soils different proportions of these ingredients are used—namely 2 parts nitrate of soda, 3 parts acid phosphate, 1 part muriate of potash, and 2 parts bone meal. The quantity for each tree is the same as for lighter soil. Still another combination which has been used in the fall is acid phosphate 700 lbs. and muriate of potash 300 lbs. at the rate of 1,500 lbs. to the acre or "proportionately to the area desired to fertilize."

In a brief paragraph devoted to the fertilizing of trees, Taylor (15) gives very definite directions for the use of chemicals. He says:

> "In case of shade or orchard trees which are not vigorous and which require feeding, recent experiments seem to show that applications of nitrate of soda and acid phosphate are effective. Quantities up to ten pounds for each tree may be used on old trees, either spread evenly over the surface of the ground underneath the tree or introduced beneath the sod in quantities of a handful deposited in the bottom of holes made by a crowbar at staggered intervals of eighteen inches. Bone meal is probably one of the best fertilizers to be used in preserving the vitality of shade trees. A successful method of applying bone meal is that of spreading it broadcast over the lawn surrounding the base of the tree. This fertilizer, which is slow acting, should be applied during the winter or very early spring months, at the rate of at least twenty-five to fifty pounds for trees from ten to twelve inches in diameter, and at a propor-

tionately less rate for trees of smaller diameter. This fertilizer should be applied at least once in two years. It is much better to apply a less amount and to fertilize the trees each year."

Laurie and Edmond (7) regard adequate data with reference to the use of complete fertilizers for trees as lacking and suggest some quickly soluble nitrogenous form to be added in the spring. "Ammonium sulphate, nitrate of soda or calcium nitrate may be used. The rate of application should vary with the size of the tree. Usually ½ pound is sufficient." For street trees where conditions are particularly unfavorable "well rotted manure should be added to good garden loam and in addition to this, such phosphoric fertilizers as bonemeal, tankage or cottonseed meal at the rate of one pound to every cubic yard."

A general consideration of the fertilization of shade trees is to be found in the chapter on this subject in Greeves-Carpenter's (5) book. The effect of undernourishment and the elements essential to the life of the tree are discussed, together with the best methods of applying fertilizers. But no definite directions are given to meet specific needs. The necessity of feeding trees before it is too late and the importance of the whole subject is well summarized, however.

A somewhat similar discussion on the feeding of shade trees by Codding (3) summarizes the main characteristics of a real tree food as follows:

"1. It must contain nitrogen to produce healthy wood and twig growth.

"2. It must contain potash to ripen the wood and give it toughness and strength.

"3. It must contain phosphorus to build up and energize the tree.

"4. It must be compounded in such form as to be readily and gradually available over the entire growing season."

In an effort to determine the mineral requirements of trees Deuber (4) has planned a series of experiments which may result in putting the whole matter on a more definite and satisfactory basis. Working with young sugar maple trees, he found that they responded to various chemical fertilizers in much the same way that various crops reacted. This was in

most cases to have been expected, but it is interesting to note that a deficiency of phosphorus failed to affect growth. Yet practically all authorities recommended bone-meal or other phosphoric fertilizers for trees. Apart from the actual ingredients of the fertilizer to be used, and the time of supplying it, much stress is laid upon the method of application. It is not thought that the various chemicals travel very far from the point of introduction, and consequently it is advisable to dig trenches or make holes with a crowbar or insert tile to carry the nutrient solution to the feeding roots. The practice of surrounding the trunk of a tree spreading 50 feet or more with a ring of manure not more than three or four feet in diameter is not calculated to be of much benefit. Even the mulching of the entire root area of a tree with manure in the fall is of little feeding worth, since the valuable part leaches out before the tree can use it next spring. Turning the manure under may be of value in that it improves the texture and water-holding property of the soil, but this is another matter.

Although it is not usually possible to cultivate the soil to any extent under shade trees, the advantage of keeping it in a state of culture is universally recognized. The roots of trees require air as well as water and an impervious covering which cuts this off is injurious, just as the continuous flooding of the roots will result in drowning the tree.

Of the necessity of watering trees under certain conditions nothing need be said at this time, though it is important to bear in mind that it must be done thoroughly instead of simply moistening the first inch or two of earth. In this connection, Smith (14) has called attention to what he calls "irrigation by rain-fed water pockets". The method which seems to have been devised in several parts of the world, but little used, is an adaptation of horizontal terracing for holding the natural rainfall. It consists simply of making a pocket in the earth near the tree or trees which will retain the water falling in that locality. The effect is to supply partially the lack of cultivation, since the pocket increases and prolongs the supply of moisture as well as carrying additional food sources to the tree.

The whole subject of feeding ornamental trees is further

complicated by the possibility that vegetation growing around the tree may have a harmful effect. The poisonous effect of grass on apple trees, which was first demonstrated by the Duke of Bedford at the Ridgmont Experimental Farm in England, has since been shown to be almost universal. There is also some evidence that the same deleterious effect may be manifested in a variety of trees. Indeed, at one time it was held by some that the principal value of fertilizers added to the soil was not as plant food but to counteract the poisons given off by adjacent vegetation. There is good reason to believe that certain trees (black walnut, for example), as well as certain herbaceous plants, are capable of interfering seriously with the healthy, vigorous growth of other plants in the vicinity.

SUMMARY

1. A review of the literature in this country and abroad shows that definite accurate information concerning the best fertilizers for ornamental and shade trees is not available in the form that it is for farm crops and other herbaceous plants.

2. Most authorities agree that some form of nitrogen is necessary, and where possible the use of green manure (legumes) is advised.

3. Nitrate of soda (Chile saltpetre) has given good results (not universally) when applied at the right time.

4. A great difference of opinion exists as to the quantity of nitrate of soda to be used for each tree. Either the proportions are given in pounds per acre, which is useless for a single ornamental tree, or the quantity for each tree of equivalent size varies tremendously.

5. No satisfactory agreement as to other fertilizers, such as those containing potash, phosphorus, etc., has been found. It is notable that few experimenters have regarded the use of lime as of importance.

6. The time of application of any fertilizer, particularly nitrate of soda, seems to be important.

7. The whole problem is complicated by the effect of cultivation or its lack, the water supply, the availability of minerals already present, the possible antagonistic action of one plant towards another, and various other factors.

It is hoped by the series of experiments now being conducted at the Garden eventually to arrive at a more definite and satisfactory method of feeding St. Louis trees. The main purpose of this preliminary article is to interest readers of the BULLETIN in the problem, to furnish them with such facts as are at present available, and possibly to cause some to carry on independent experiments, the results of which may be reported in a subsequent issue of the BULLETIN. The Garden is anxious to enlist the co-operation of as many investigators as possible and will be glad to outline individual experiments for any who may be willing to assist in finding an answer to the important question "What, when, and how should we feed our trees?"

Note. After the above was written there was received Bulletin 4 from the Research Department of the Davey Tree Expert Co., entitled "Fertilization of Shade Trees." Considerable space is given to a review of the use of fertilizers in orchard practice, and there is described an experiment designed to answer the question "when to apply fertilizer." American elm, apple, and Norway maple were used, and while no attempt is made to draw a final conclusion, from two years' records the following summary may be quoted:

"The continued growth of the shade tree industry points to the need of further knowledge on the fertilizer requirements of shade trees and of experiments designed to answer the problems of fertilization under conditions of commercial shade tree culture.

"An examination of these conditions and of orcharding practices shows that the horticultural experiments conducted to date give little direct aid or advice to the shade tree worker.

"Of the many problems which might be investigated the problem of 'When to Apply Fertilizers' seems to offer the most promising opportunity for field experiments.

"This publication records results of a 378-tree experiment on the use of a chemical fertilizer in late fall vs. the same material in early spring. Three species of trees are included in the experiment.

"Two years' results indicate but little difference between fall and spring treatments but a decided benefit from either treatment compared with trees which received no fertilizer."

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BEWARE THE CASTOR-OIL BEAN

It may not be generally known that the common castor-oil beans contain one of the most powerful of all poisons. There are many cases on record of persons having become seriously ill by eating seeds, death resulting in 6 per cent of the cases on record.

The poison present in these seed has been given the name of Ricin, so named from the generic name of the castor-oil plant which is Ricinus. This poison is very similar in its action to that of Crotin, as found in croton-oil seeds, Abrin in jequirity seeds, as well as that of Robin present in the bark of the black locust tree. The chemical composition of Ricin is similar to snake venom, so that poisoning from castor beans is very similar to that produced by the bite of a poisonous snake.

An interesting fact about these seeds is that if the castor oil is extracted by the so-called "cold method," Ricin is not present in the oil. However, if the expression of the seeds

CASTOR-OIL BEANS (NATURAL SIZE).

CASTOR-OIL PLANT.

is accomplished by subjecting them to heat the oil will contain Ricin.

Five or six seeds are fatal to a child and twenty to an adult. In view of the fact that these seeds have beautiful external markings which might attract the attention of a child, the castor-oil plant should be used with caution as a decorative plant about the home. The seeds, although somewhat oily in character, also possess a peculiar sweetish taste which may prove to be an added inducement for children to eat them. Every member of the household should be aware of the dangerous character of the seed

The poison symptoms consist of a severe gastroenteritis, with nausea, headache, persistent vomiting, colic, sometimes bloody diarrhea, thirst, emaciation, and great debility. In addition there may be convulsions, internal hemorrhages, together with paralysis of the respiratory and vasomotor centers. Although the persistent vomiting and colic may set in during the course of a few hours, the real toxic symptoms may be delayed for several days. In case a sufficient quantity of the seeds have been eaten to produce death, this would take place in from six to eight days from convulsions or from exhaustion.

In a series of laboratory experiments it has been shown that Ricin is fatal to a rabbit when a dose one two-millionths of the weight of the animal is administered. This, on a comparative weight basis, would place the fatal dose of Ricin as being about 1/2000 of a grain for an adult. The poison is destroyed to a considerable extent in the alimentary canal, thus accounting for the fact that the mortality from such a powerful poison is so low.

It may also be well to mention at this time the dangers attendant on jequirity seeds, called by some "prayer beads". These seeds are employed to a considerable extent as beads and may at times be eaten by children. Owing to their very hard covering they would undoubtedly pass through the alimentary canal without becoming disintegrated, with no poisonous effect developing. Such would not be the case if the seeds were crushed and then eaten, for as stated previously they contain the powerful poison known as Abrin.

NOTES

A party of about five-hundred 4-H Club Boys and Girls from thirty-five different states, attending the National Dairy Show in St. Louis, visited the Garden, October 14.

The Hon. Gustav Boess, Mayor of Berlin, Germany, and an official party of colleagues, who are making visits to several cities in the United States, visited the Garden, October 18.

The September Bulletin of the Garden Club of America contains an article by Dr. George T. Moore, Director of the Garden, on "The Tropical Station of the Missouri Botanical Garden."

Dr. George T. Moore addressed the Parent-Teachers' Association of the George Dewey School, October 9, on "The Plant Commonwealth."

Mr. George H. Pring, Superintendent of the Garden, spoke before the Scottish Rite Club, at a luncheon at the American Annex, October 8, on "Activities of the Missouri Botanical Garden."

The second number of the Annals of the Missouri Botanical Garden, consisting of a paper by Dr. David H. Linder, Mycologist to the Garden, entitled "A Monograph of the Helicosporous Fungi Imperfecti," has recently been issued.

Dr. Edgar Anderson, Geneticist to the Garden, is spending a year in study at the John Innes Horticultural Institution near London, he having been awarded a fellowship by the National Research Council.

The bouquet of orchids which the Garden annually presents to the Veiled Prophet Queen to be carried at the Ball was exhibited in the floral display house at the Garden on the next day. Included in the bouquet were the following: 24 flowers of *Cattleya labiata*, native of Brazil, 100 of *Dendrobium phalaenopsis Schroederianum*, from Australia, 3 *Vanda suavis*, from Java, 19 *Phalaenopsis Rimestadiana*, from Java, and *P. Esmeralda*, from Cochin China, 22 *Brassavola nodosa*, from Panama, and 24 hybrids including Cattleyas, Laeliocattleyas, Brassocattleyas, and Cypripediums.

Appointments in the Henry Shaw School of Botany of Washington University for the academic year 1929-30 are as

follows: Instructor in Botany, Miss Martha L. Beardsley, A. B., M. S.; Assistants in Botany, Alexander F. Bucholtz, B. S., M. S., Miss Dorothy S. Francis, A. B., and Harry J. Fuller, A. B.; Rufus J. Lackland Research Fellows in Botany, Earl E. Berkley, A. B., H. H. Card, A. B., A. M., George J. Goodman, A. B., Charles L. Hitchcock, A. B., A. M., and John T. Johnson, A. B., A. M.; Jessie R. Barr Fellows in Botany, Miss Marion Child, A. B., M. S., and Mrs. Eva M. Fling Roush, A. B., A. M.; Graduate Scholarships, Miss Caroline K. Allen, A. B., M. S., Miss Josephine Darlington, A. B., B. S. in Forestry, and Julian A. Steyermark, A. B.

STATISTICAL INFORMATION FOR SEPTEMBER, 1929

GARDEN ATTENDANCE:

Total number of visitors 33,490

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought 34
Total number of books and pamphlets donated 135

PLANT ACCESSIONS:

Total number of plants donated 35
Total number of packets of seed donated 12

HERBARIUM ACCESSIONS:

By Purchase—
Steinbach, Dr. Josè—Plants of Bolivia 498
Mexia, Mrs. Ynes—Plants of Alaska 262

By Gift—
Bettis, Mrs. James R.—*Gerardia tenuifolia* Vahl, from Missouri 1
Fellers, M. C.—*Ginkgo biloba* L. from horticulture 1
Linder, Dr. David—Plants of Missouri 8
Mathias, Miss Mildred—*Epipactis pubescens* (Willd.) A. A. Eaton from Missouri 1
Warren, F. A.—*Paspalum mucronatum* Muhl. from Missouri 1

By Exchange—
Field Museum of Natural History—Miscellaneous herbarium duplicates 245

By Field Work—
Kellogg, John H.—Plants of Missouri 4
Mathias, Miss Mildred—Plants of western United States .. 397

Total 1,418

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1929

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
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MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XVII NOVEMBER, 1929 No. 9

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OF THE MISSOURI BOTANICAL GARDEN

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CHRYSANTHEMUM SHOW, 1929.

Missouri Botanical Garden Bulletin

Vol. XVII NOVEMBER, 1929 No. 9

THE EVOLUTION OF THE CHRYSANTHEMUM SHOW

Of all the exhibits of indoor flowering plants given at the Garden each year, the chrysanthemum show continues to be the most popular. No matter how elaborate other shows may be or how rare and unusual the flower, nothing in the mind of the general public can compete with the chrysanthemum.

This may be due in part to the fact that the chrysanthemum show is the oldest, not only at the Garden but in St. Louis. People in St. Louis formed the habit years ago of attending in the fall a display of these plants, and they look forward to it and expect it. In spite of the gradual addition of exhibits of bulbs, cinerarias, roses, azaleas, orchids, etc., at the Garden, each one presumably as beautiful and in some cases more interesting than the chrysanthemums, the attendance at the fall showing of "mums" always exceeds that at other times of the year and sometimes equals that at two or three other shows combined.

About 1890 the Florists' Club of St. Louis began putting on a three-day chrysanthemum show in the old Exposition Building, and this was repeated for some ten years. Practically the only part the Garden took in these exhibits was to offer certain prizes. In both 1891 and 1892 premiums were given for new seedling chrysanthemums, and in 1893 the first award of the Henry Shaw Gold Medal went to J. Dorner and Son, of Lafayette, Indiana, for the chrysanthemum "Major Bonnaffon."

The first attempt of the Garden to stage a chrysanthemum show was in November, 1905, although it was represented by a mass display of some fifty varieties of chrysanthemums at

the flower show held during November, 1904, on the grounds of the Louisiana Purchase Exposition. The shows of the St. Louis Florists' Club were abandoned in 1902, and while there was a break of two or three years, the Garden show may properly be regarded as the successor to the display started by the florists nearly fifteen years before.

At this first Garden show some 2000 chrysanthemum plants, representing 211 varieties, were displayed under canvas and in a small adjoining house, there being no house large enough to contain the entire exhibit until many years later. It is interesting to note that the attendance was about 25,000 people, one-fourth of the visitors for that year. Another fourth of the visitors came on the two Sundays of the year on which the Garden was open. In fact, for many years one-half of the yearly attendance was on these two Sundays and at the time of the chrysanthemum show.

The accompanying photographs illustrate the development of the chrysanthemum show at the Garden much better than any printed description. Even in the early years, under difficulties which now can hardly be appreciated, the exhibit attracted much attention and most favorable comment. A Japanese visitor in 1906 pronounced it to "equal if not surpass the most luxuriant royal exhibits of Japan." And yet this was the year when the plants, sheltered only by a thin canvas tent, were subjected to a temperature as low as 19° F., and for the most of the time the thermometer ranged between 30 and 46° F. On one of the days the ground was covered with 2½ inches of snow, three days it rained, and for two whole days a heavy sleet storm prevailed. Nearly half the time a dense pall of smoke overhung the city, at times making it impossible to see the plants. The United Railways Co. generously installed, on a few hours' notice, electric lights in the tent in an attempt to overcome the difficulty. In fact this gratuitous service of the street car company was continued for a number of years, making it possible to keep the show open in the evenings.

In 1911, for the first time since the chrysanthemum display was inaugurated at the Garden, no show was held. Although the usual number of plants had been provided and were arranged under canvas, a heavy gale destroyed the tent on

DISPLAY MADE BY MISSOURI BOTANICAL GARDEN AT THE LOUISIANA PURCHASE EXPOSITION, 1904.

FIRST CHRYSANTHEMUM SHOW HELD AT THE GARDEN, 1905. EXTERIOR OF TENT.

CHRYSANTHEMUM SHOW, 1905. INTERIOR OF HOUSE.

CHRYSANTHEMUM SHOW, 1906. EXTERIOR OF TENT, OVER PARTERRE.

CHRYSANTHEMUM SHOW, 1907. INTERIOR OF TENT.

CHRYSANTHEMUM SHOW, 1913.

CHRYSANTHEMUM SHOW, 1915. FIRST SHOW IN FLORAL DISPLAY HOUSE.

CHRYSANTHEMUM SHOW, 1918.

CHRYSANTHEMUM SHOW, 1921.

CHRYSANTHEMUM SHOW, 1922.

the night before the opening of the show and a fall of over 70° in temperature froze every plant in spite of all efforts to save them.

In 1912 the construction of the new conservatory was begun, and although far from complete by November of that year it was possible to display a considerable number of chrysanthemums in the front half of the north greenhouse, now occupied by the coffee and banana plantation. Naturally not more than eight or nine hundred plants could be shown in this limited area, but the number of visitors was up to the average. In order that the public might get into this house it was necessary to build a special platform and wooden runways over the foundations of the present fern house.

The following year this entire house was devoted to the display, and about 1600 plants were used. A brick wall was laid down the center of the house, and masses of foliage plants were used between the groups of flowers. New seedlings were shown, and special effort was made to demonstrate what could be done with chrysanthemums when trained into formal designs. A somewhat similar display was made in this house the following November.

The present floral display house, especially built to accommodate the various flower shows held throughout the season, was opened for the first time to the public on the last Sunday in October, 1915. At last the Garden was in a position to arrange chrysanthemums and other blooming material in a way calculated to appeal to all flower lovers, and it is safe to say that no one feature at the Garden has received so much favorable comment as the succession of flower shows held since the floral display house was erected.

Reference to the illustrations indicates the gradual improvement which has taken place in the arrangement of chrysanthemums in this house. In 1920 the hanging baskets of chrysanthemums were introduced for the first time. This feature, which was originated at the Garden, was developed primarily to fill the vacant space between the roof and the plants on the floor, which had always detracted from the artistic effect of the house when viewed from the terrace. Only varieties having a pendant type of growth can be used for the baskets,

and but little advance has been made since the original single white and yellow and pink forms were selected.

By 1921 the attendance at the chrysanthemum show had grown to such an extent that it was necessary to alter the arrangement of the plants so that the large Sunday crowds could be conducted straight through the house and out at the north doorway. The necessity of handling from five to ten thousand visitors in about four hours on a Sunday afternoon is something which must always be kept in mind in planning the design of any flower show. While "one-way traffic," making the circuit of the house, can always be arranged, this is not sufficient on days of big crowds, and for the past eight years it has been necessary at some time or other to open the north exit.

The Japanese-garden setting for the chrysanthemum show was attempted for the first time last year. By the use of bamboo fencing along the wall, a rush-thatched gateway at the rear, small "torii" gates at the entrances, and an old stone lantern, a distinctly Japanese atmosphere was produced. The effect was so appropriate and so pleasing that this year an even greater effort was made to carry out the Japanese setting, and it is believed that in developing this plan the climax has been reached so far as general design is concerned. While no two chrysanthemum shows are ever alike and there will always be new features, the Japanese setting is so far superior to anything previously attempted that the idea will probably be perpetuated indefinitely.

Beginning with a comparatively small number of well-grown beautiful plants, which had to be shown in a tent, the Garden chrysanthemum show has developed gradually through the past thirty-four years into one of the most attractive displays of its kind in the country.

THE HISTORY OF THE CULTIVATED CHRYSANTHEMUM

In the October, 1915, number of the Missouri Botanical Garden BULLETIN appeared an account of "The Evolution of the Cultivated Chrysanthemum". This bulletin has long been

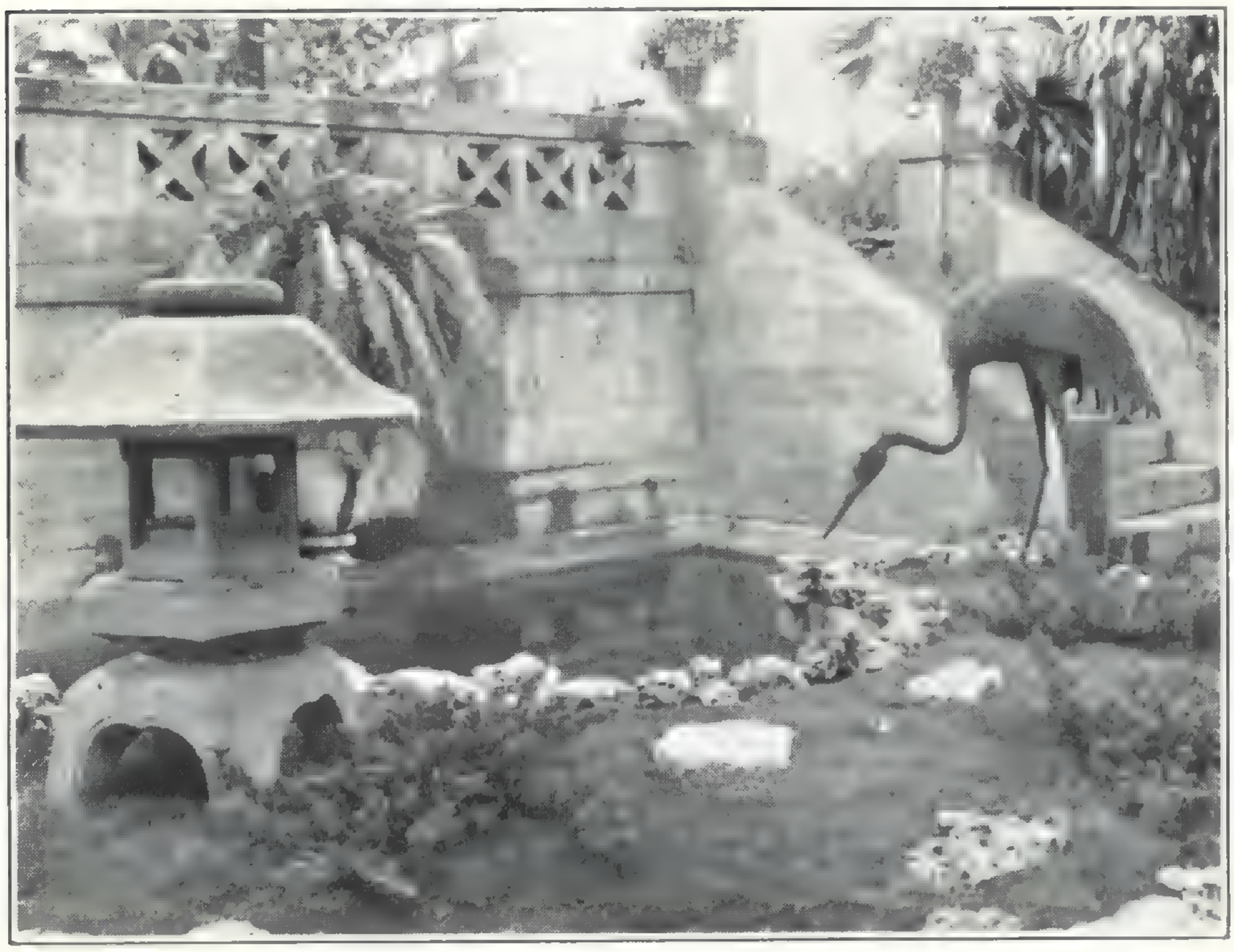
CHRYSANTHEMUM SHOW, 1925.

CHRYSANTHEMUM SHOW, 1927.

General View.

View of Hanging Basket.

CHRYSANTHEMUM SHOW, 1928.



View Around Pool.

Looking South.

CHRYSANTHEMUM SHOW, 1929.

AIRPLANE VIEW OF CHRYSANTHEMUM SHOW, 1929

out of print, and in the meantime considerable additional information concerning the history of the chrysanthemum in the United States has been acquired. For purposes of completeness the early history of the chrysanthemum, previous to its introduction into the United States, is reprinted as it appeared in Volume III, No. 10, of the BULLETIN.

THE EVOLUTION OF THE CULTIVATED CHRYSANTHEMUM

The chrysanthemums at the Garden this year will be shown in the new floral display house which has just been completed and, for the special purposes designed, is probably the finest in the country, if not in the world. The exhibition will be particularly noteworthy, comprising 3,000 plants of 500 varieties, among which are the following new specimens:

Bob Pulling (yellow)
Calumet (bronze)
Crystal Gem (large early white)
Earl Kitchener (amaranth, silvery reverse)
Garnet Gem (early bright red)
Golden Queen (early yellow)
Illona (lavender pompon)
Kewanee (buckskin or chamois)
Kewanee (yellow)
Mankator (amaranth)
Marigold (yellow)
Modello (orange)
Mrs. H. J. Jones ("green chrysanthemum")
Mrs. R. C. Pulling (yellow)
Mrs. T. P. Mitchel (white)
Rodi (purplish rose pompon)
Silver King (white)

The development of the cultivated chrysanthemum furnishes a most remarkable example of the ingenuity and perseverance of the plant hybridist. Although a 16-petalled chrysanthemum is the emblem of Japan and this flower is called the "flower of Japan," all evidence goes to show that the chrysanthemum is indigenous to China. Later it was imported to Japan, where it achieved a success far exceeding that in its native country. According to Chinese history, the chrysanthemum was cultivated in China over 2,000 years ago. Confucius, who supposedly lived 500 B. C., mentions the flower under the name, "Li-Ki," and some Chinese pottery, now preserved in the British Museum, which dates as early as 1426-1436, bears an exact replica of one of the earlier forms of the chrysanthemum. Previous to the importation of the chrysanthemum into Europe, the Chinese were known to graft certain kinds and cultivate specimens

similar to the single-stemmed varieties of the present day. They even adopted a style of nomenclature which bears little resemblance to our modern system; for instance, one favorite was called "The Drunken Lady," owing to the drooping habit of the flowers during the day.

The earliest record of the introduction of the chrysanthemum into Europe dates from 1688, when it was brought into Holland by Breynius, a merchant of Dantzig, who, in the next year, published his "Prodromus Plantarum Rariorum," which contained accurate descriptions of the varieties then growing in Holland. In spite of its easy cultivation, however, interest in the chrysanthemum soon died out and the varieties described by Breynius passed out of existence in Holland. England is the next country to which we have any record of the chrysanthemum being imported, being brought this time in a dried state from China, in 1698-1703, by James Cunningham, Surgeon to the East India Company in Amoy, China. In 1764 living specimens were introduced into England; these were sent from Nimpu (probably Ningpo), China, and were cultivated by Philip Miller. The plants were also grown in the famous Chelsea Garden, in London, and it was from here that herbarium specimens were collected and preserved which are accessible at the present day. The specimens are labeled *Chrysanthemum indicum* and show flowers with small double heads, undoubtedly being one of the true "indicum" type.

The next important step in chrysanthemum culture was in 1789 when a French merchant, M. Blancard, brought home three varieties from China: one white, one violet, and one purplish. Within three years there was scarcely a garden in Versailles that had not adopted the chrysanthemum, the flowers then being about the size of the present-day carnation. M. Blancard's purple variety was introduced into England in 1790. Concerning this introduction, Sabine writes: "This is the purple variety; it had been transmitted to this country from France in 1790, and after its arrival here the changeable white was obtained from it by cultivation. Between the years 1798 and 1808, inclusive, eight new varieties were imported from China into England in the following order: the rose and buff together, in 1798; the golden yellow and the quilled yellow together, in 1802; the sulphur yellow at the latter end of

THE ORIGINAL CHRYSANTHEMUM CONTRASTED WITH A MODERN POMPON VARIETY DEVELOPED FROM IT.

CHRYSANTHEMUM PETALS FROM VARIOUS VARIETIES SHOWING THE CHANGES FROM THE ORIGINAL WILD TYPE (SMALL FLOWER NEAR CENTER) INDUCED BY SELECTION AND CROSS-BREEDING.

the same year; the Spanish brown, in 1806; and the quilled white and large lilac together, in 1808. Of these the sulphur yellow was imported for Thomas Evans, Esq., of Stepney, and the remaining seven sorts for Sir Abraham Hume. Later importations have produced two others, the tasseled white, in 1816, and the superb white, in 1817.''

For a considerable time after their introduction the French and English gardeners had been experimenting with the object of raising chrysanthemums from seed. Success was finally attained by a French officer, M. Bernet. The previous year he had discovered some withered flower heads in which he was surprised to find seeds bearing all the signs of perfect maturity. Keeping his discovery a secret he carefully tended the seeds himself, and in the fall of 1827 was rewarded with several fine varieties of plants.

In 1843 Mr. Robert Fortune was sent to China by the Royal Horticultural Society of London in search of rare plants. On his return in 1846 he brought, among other curiosities, two small-flowered chrysanthemums known as the Chusan Daisy and Chinese Minimum. These, according to James Salter, were probably varieties from the true *Chrysanthemum indicum* of Linnaeus. The plants, however, did not find favor with the English growers owing to their small flowers, but they were appreciated by the French and were used for hybridizing. According to several authorities, the pompons of the present-day chrysanthemum originated from these two varieties. The introduction of the Japanese specimens into Europe dates from 1862, when they were brought back by Mr. Fortune from his second trip to China. Salter, in describing these new plants, says: ''Some varieties were spotted and striped; others were fantastic forms called Dragons; and one noteworthy specimen was a beautiful fringed white flower, in appearance more like a Japanese pink than a chrysanthemum.''

The development of the chrysanthemum before its introduction into Europe is a mystery. Hemsley states in the ''Gardener's Chronicle,'' of 1889, that ''it is impossible to determine the parentage of some of the Chinese double chrysanthemums, and it is highly probable that some of them are of hybrid origin between *Chrysanthemum indicum*, the small

yellow, and *Chrysanthemum morifolium* (*sinense*). The same may be said with regard to some of the early figures of double varieties of chrysanthemums, which authors have identified with one or the other of the two adopted species. The slender Chusan Daisy, the parent of all the pompons, for example, is probably of mixed origin, though it may be pure *C. indicum.*''

The true *Chrysanthemum indicum* in its wild state is found from Hongkong to Pekin, the ray- and disk-flowers both being yellow. *Chrysanthemum morifolium* (*C. sinense*) is found in the Luchu Archipelago and the Chinese central province of Hupeh. It is more robust than *C. indicum*, the leaves are thicker and tomentose, and the ray-flowers are a different color from the disk-flowers.

Mr. E. H. Wilson reports finding both *Chrysanthemum morifolium* and *C. indicum* growing wild in Ichang, China, but regards *C. morifolium* as having played a more important part in the ancestry of the modern chrysanthemum than *C. indicum.*

THE CULTIVATED CHRYSANTHEMUM IN THE UNITED STATES

The greatest uncertainty, as well as difference of opinion, has existed concerning the date of introduction into the United States of the cultivated chrysanthemum. Smith and Laurie, in Bulletin 186 of the Agricultural Experiment Station of Michigan State College, say: ''The early history of the cultivation of the chrysanthemum in the United States is not available. Doubtless it was introduced in America soon after its development in England in 1795 because the florists of that period were active in obtaining novelties from their eastern correspondents.'' In Hovey's ''American Gardener's Magazine and Register,'' in Volume 1, published in Boston in 1835, we find the following: ''At what time the first chrysanthemums were introduced into this country we have no accurate account, but we may suppose it to have been about the years 1805-6. Nearly all the varieties have been subsequently imported, and about fifty kinds are said to exist in our gardens. We have never, however, seen more than thirty, having cultivated that number for the two last seasons.'' In the

"American Chrysanthemum Annual" for 1895, in an article by Edgar Sanders, the late Shirley Hibberd is given as authority for the statement that the chrysanthemum was introduced into America in about 1820 or earlier, "but so far as we have been able to trace, it is not until 1826 that we have actual evidence of the presence of the plant in this country. A Mr. Prince, writing under date of February 14th, in that year, and describing the stock cultivated in his nursery at Flushing, N. Y., among many other plants enumerates thirty-two varieties of the Chrysanthemum." It is interesting to note that it is this same Mr. Prince who furnishes us with the first authentic information concerning the introduction of the cultivated chrysanthemum into this country and the date is much earlier than that given by any other author. In "A short treatise on horticulture, embracing descriptions of a great variety of fruit and ornamental trees and shrubs, grape vines, bulbous flowers, green-house trees and plants, etc., nearly all of which are at present comprised in the collection of the Linnaean Botanic Garden, at Flushing, near New York, with directions for their culture, management, etc., by William Prince, Proprietor of the Establishment, New York, 1828," on page 151 occurs the following:

> "*Chinese chrysanthemum or Chrysanthemum sinense.*—This plant is sometimes called Artemesia. The first variety was introduced to this country about the year 1798, having been carried from China to Europe in 1790. This was the Dark Purple, and was imported by John Stevens, Esq., of Hoboken, N. J., a gentleman distinguished for his love of botany, as well as for other departments of science. About the year 1814 and 1815, many other varieties were introduced; but it remained for the last four years to present to the view the rich accumulation of splendid varieties which had doubtless been cultivated for ages in China, unseen and unknown to the rest of the world."

Thus it appears that the cultivated chrysanthemum was introduced into the United States much earlier than is ordinarily supposed. By the time the Massachusetts Horticultural Society was incorporated in 1829 the interest in this flower had increased considerably. There were certainly seventeen or eighteen known varieties recognized. From this time on interest in the chrysanthemum rapidly developed. The credit of being the first American to raise seedling chrysan-

themums is usually given to Dr. H. P. Walcott, of Cambridge, Mass., who certainly was successful in this direction by 1879. Mr. John Thorpe, of Long Island, was another prominent grower of seedling chrysanthemums at about this time, but he himself states that Dr. Walcott antedated him by three or four years. However, long before Mr. Thorpe began experimenting with the chrysanthemum Robert Kilvington, a Philadelphia grower, exhibited on November 16, 1841, before the Pennsylvania Horticultural Society, a new chrysanthemum raised by him from seed and called "William Penn." He was awarded by the Society a prize for the best American seedling, the committee stating that "This prize seedling chrysanthemum is decidedly the finest variety ever presented to this Society." Six years later, in the second volume of the "American Horticulturist," in an article commenting on the new chrysanthemum "William Penn", it is described as "one of the most perfectly formed flowers of the genus we have ever seen, each blossom very full double, symmetrically shaped, and almost globular in form. The color white; and it is, on the whole, much superior to any of the new European varieties of this old autumnal favorite that have reached us."

It was not until after the middle of the last century that the chrysanthemum began to be regarded as a greenhouse plant. Previous to that time it had been grown almost exclusively as a garden flower in regions where the fall season was favorable for its development. While it is true that Mr. Samuel Brookes of London had settled in Chicago in 1833 and had soon become interested in the chrysanthemum, it was not until 1850 or later that this flower received in the West the attention which had already been manifested along the Atlantic coast. Mr. Brookes, however, has been called the father of the chrysanthemum in this country, and according to one authority "At the time of his decease (1875) there was probably no other man who could claim to have been acquainted with the chrysanthemum for so long a period."

The first regular chrysanthemum exhibit in the country was held under the auspices of the Massachusetts Horticultural Society in 1868, but as early as 1844 we find in an account of a flower show held by the same society that "The show of chrysanthemums on November 2nd was very fine." In 1846

the Pennsylvania Horticultural Society awarded two prizes for the best twelve named varieties, and special mention is made of the "general fine display of the coming flower."

Perhaps the one thing which brought the chrysanthemum into prominence and helped to establish it as a favorite fall flower was the appearance of the new variety "Mrs. Alpheus Hardy." The fact that this new variety brought the unprecedented price of $1500 did much to advertise the flower, although the history of its introduction may have had something to do with this. It was recorded that Alpheus Hardy, a sea captain sailing from Japan to Boston, discovered a stowaway whom ordinarily he would have been compelled to return to Japan. However, due to the intercession of Mrs. Hardy, who was aboard, the captain continued his journey to Boston, and the stowaway was educated at Harvard University by Mrs. Hardy. Upon returning to Japan the stowaway, wishing to show his appreciation of what had been done for him, sent to Mrs. Hardy a collection of cuttings of chrysanthemums. These were turned over to a florist in Cambridge, and the first white hairy or ciliated type ever grown in this country resulted. It was named "Mrs. Alpheus Hardy." Some fifty varieties, most of them American-grown hybrids, have been developed from this original hairy type.

NOTES

Dr. George T. Moore, Director of the Garden, left for New York, November 22, to attend a meeting of the trustees of the American Orchid Society.

Dr. George T. Moore spoke at a meeting of the Women's Overseas Service League, November 19, on "What Goes on in the Soil."

Mr. L. P. Jensen, Arboriculturist at the Gray Summit Extension, gave an illustrated talk before the St. Louis Horticultural Society, November 1, on "Conservation of Native Plants."

Dr. Roland La Garde, Research Assistant at the Missouri Botanical Garden, gave a lecture, November 7, on "The His-

tory and Culture of Orchids'' before the class in gardening of the St. Louis School of Occupational Therapy.

The elementary school principals and teachers of the St. Louis Public Schools visited the Garden, October 26, and were addressed by Dr. Moore regarding plans for co-operation between the Garden and the public schools.

Recent visitors to the Garden include Dr. A. F. Blakeslee, assistant director, Carnegie Institute for Experimental Evolution, Cold Spring Harbor, N. Y., October 22; Prof. G. H. Bretnall, professor of botany, Christian College, Columbia, Mo., accompanied by his class in botany, October 21; the State Teachers' Convention, November 14.

The following talks have been given recently by Mr. G. H. Pring, Superintendent of the Garden: October 22, ''Orchids,'' before the Kirkwood Literary Society; October 23, ''Activities of the Missouri Botanical Garden,'' before the West End Lions Club, at the Forest Park Hotel; November 4, ''Commercial Orchids for the Retail Florists,'' before the St. Louis Retail Florists' Association.

Events of interest at the Gray Summit Extension include the following: On November 11 the Board of Trustees of the Garden met for a tour of inspection of the greenhouses and grounds. On October 3 the Faculty and Board of Directors of the St. Louis College of Pharmacy were guests at the Extension, and on October 6 the Garden Club of Gray Summit held a meeting there. Mr. L. P. Jensen, Arboriculturist to the Garden, gave a talk to both groups on "The Gray Summit Extension."

STATISTICAL INFORMATION FOR OCTOBER, 1929

GARDEN ATTENDANCE:

Total number of visitors.....35,152

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 20
Total number of books and pamphlets donated..... 124

PLANT ACCESSIONS:

Total number of plants donated..... 317
Total number of packets of seed donated..... 128

PLANT DISTRIBUTION:

Total number of plants distributed as gifts..... 205

HERBARIUM ACCESSIONS:

By Purchase—

Seymour, Rev. Frank S.—Plants of Massachusetts..... 100

By Gift—

Anderson, Dr. E.—Plants of New England..... 10
Cooper, Delmar C.—*Bougainvillea glabra* Choisy from horticulture 1
La Garde, Dr. Roland—Fungi from Minnesota..... 6
Linder, Dr. David—*Comandra umbellata* (L.) Nutt. from Massachusetts 2
Mathias, Miss Mildred—Plants of Missouri..... 8
Roush, Mrs. Eva M. Fling—Plants of Ohio, West Virginia, Indiana, Illinois, and Missouri..... 80
Showalter, Dr. A. M.—Plants of Missouri..... 9

By Exchange—

Glück, Prof. Hugo—Plants of Europe..... 275
United States Department of Agriculture, by Prof. A. S. Hitchcock, "North American Grasses," Cent. X., Nos. 901-1000 100

By Field Work—

Kellogg, John H.—Plants of Missouri..... 4

Total..... 595

FLORAL DISPLAYS OF SPECIAL INTEREST IN 1929

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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Missouri Botanical Garden Bulletin

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Floral Displays of Special Interest in 1929

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BADLY INFESTED ASH TREE.

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A RARE AFRICAN CLIMBING PLANT IN FLOWER

Camoensia maxima is a remarkable leguminous climbing plant very rarely seen in greenhouses in this country. It was discovered by Christian Smith, the botanist attached to the unfortunate expedition of Captain Tuckey to the Congo River in 1818, and the original specimens are preserved in the British Museum.

Camoensia maxima was first introduced into cultivation in 1873 by Monteiro, who sent seeds to Kew Gardens, London, England. These germinated readily and the plants were subsequently propagated vegetatively by cuttings and distributed. The first of these to flower was in the botanical gardens of Trinidad in 1882, and at a later date it was reported as blooming at Kew and Edinburgh, Scotland. Monteiro describes the plant as growing on the sides of hills at Quiballa, in western Africa, in latitude 7′ 40° S., and he first noticed it as soon as he left the gneiss formation and entered that of mica slate where its stout roots spread in the hard clay of decomposed rock entangled with those of companion plants.

The specimen at the Missouri Botanical Garden was received in April, 1918, from the Plant Introduction Office of the United States Department of Agriculture (SPI 7344). It was grown as a pot plant in the warmest house for three years, when it had reached sufficient size to warrant planting out, and was then placed in the aroid house in a natural clay loam. Judging from its behavior here it cannot be looked upon as a fast grower under greenhouse cultivation. However, in the tropics it grows luxuriantly. A huge specimen was observed and photographed by the writer during a visit

to the Hope Botanic Gardens, Kingston, Jamaica, in 1924. According to the records there it was one of the original plants sent from Kew, and when first received it was planted out in a small bed. It has now developed into a large circular specimen, twenty feet in diameter, presenting a pendant semi-shrubby appearance, its flowering branches producing hundreds of festoons of milk-white flowers. The Garden plant produced three small flowers for the first time last year. At present it has upwards of forty blossoms and will probably be in flower for about two weeks.

Camoensia consists of but two species, and Bentham states: "This genus stands alone in Leguminosae, as combining the lofty climbing woody stem and habits of many Dalbergieae with the digitately trifoliate leaves of Podalyrieae and Genisteae, whilst the flowers place it amongst Sophoreae." The name Camoensia was given by Dr. Welwitsch as a tribute to the illustrious Portugese poet, Luis Camoes. It is a woody climber with pendulous flowering branches, the young shoots, petioles, and inflorescence having a peculiar brown scurfy deciduous woolly covering. The leaves are digitately trifoliate, somewhat resembling the poison ivy. The flowers are most peculiar in their formation, possessing bunches of milk-white petals which are tinged with gold on the fringed edge for the first day, the following day discoloring to a chocolate, and finally dropping off from the vase-shaped calyx. Of the five segments the standard, which is fan-shaped and more than three inches in diameter, overhangs the four narrow lower ones. Looking up at the flowers one gets the effect of a fan, shielding the combined lower petals, long filamentous stamens, and the pistil.

HARDY CHRYSANTHEMUMS FOR THE AMATEUR

Many varieties of chrysanthemums exhibited at the shows during the past November bore the names of persons, as, for instance, "William Turner," "Mrs. J. Leslie Davis," "Mrs. H. S. Firestone," etc. These varietal names aroused the curiosity of many visitors, who frequently asked, "Did Mrs. Firestone grow this plant, and is she exhibiting it in this show?" Many other plants, such as iris, roses, and peonies,

CAMOENSIA MAXIMA.

"MRS. G. G. MASON" AND "CHRYSALORA", TWO SINGLE-STEM VARIETIES GROWN BY MR. HERR OF BELLEVILLE, ILLINOIS.

have varieties named for persons, but the public take for granted that these names help to separate or distinguish one variety from another. If these interested visitors are told that they can grow chrysanthemums similar to the ones they are admiring, they will doubt the statement, for it almost seems unbelievable that such fine chrysanthemums can be grown outdoors without the aid of a conservatory. Many are dubious simply because they have never seen any one in this region grow any chrysanthemums other than a few of the hardy ones. Some years the so-called hardy chrysanthemums are cut down by an early frost before the flowers have fully developed, but this year no killing frost occurred until November 20.

For a number of years Mr. Frank Herr of Belleville, Illinois, has been growing some very good chrysanthemums which he displays on his veranda. A trip to Belleville this fall to secure photographs of Mr. Herr's chrysanthemums proved to be very enlightening as to methods of culture. Mr. Herr said that his chrysanthemums never see the inside of a house and that the only time they are under cover is during the winter in the cold-frame and in the fall when they are on his veranda.

Possibly it would be well to describe the life history of a chrysanthemum plant so that a clearer conception of Mr. Herr's methods may be had. About the time chrysanthemums are coming into bloom a number of sprouts or suckers develop at the base of the plant. These are the shoots that will be grown into plants for the next blooming season. These slips are placed in sand some time in late March or early April, and when rooted are grown on in pots and subsequently repotted when necessary. After a cutting has become established in its first pot and has grown about three inches in height, the center is pinched out to cause the plant to branch. As the several branches become four to five inches long they in turn are pinched. The number of times a bush chrysanthemum is pinched will govern the number of branches in the mature plant and also the number of flowers. By midsummer some of the plants will have become quite large, and they should then be staked and tied, using bamboo or stout wire stakes. After growing a variety several seasons one becomes familiar with its habits and the size of the flowers and in

the future will know just how many branches to leave on a plant. No pinching should be done after the middle of August, otherwise the plant will not have sufficient time to develop the flower buds. A single-stem chrysanthemum is one where only one flower is grown to a plant. Such varieties bear unusually large flowers and require more attention than the bush plants. The beginner who has never grown a chrysanthemum should at first confine his attention to bush plants, and then as he acquires more knowledge of the plant he may try the large-flowering varieties. Plate 35 shows two single-stem varieties of chrysanthemums grown by Mr. Herr, the variety "Mrs. G. G. Mason" having been grown to seven flowers and "Chrysalora" to eighteen flowers. Because a chrysanthemum is placed in the single-stem or large-flowered class does not imply that the plant should have only one flower, but several branches may be kept, the flowers of course not being quite as large as when only one shoot is retained. When a plant is trained to only one blossom it becomes too tall and will present difficulties for the amateur as it reaches maturity.

Not all varieties of chrysanthemums bloom at the same time. Some begin to bloom in October and others only unfold their petals in late November. Without the aid of a conservatory it will be impossible to bring the late-flowering varieties into bloom before a heavy frost. In selecting varieties to be grown outdoors it is imperative that only the early varieties be chosen, and to aid the amateur in making his selection a list of early large-flowering varieties and also early bush varieties will be found at the end of this article.

The next question that will confront the grower is where to obtain plants to start with. Seed-houses and perennial nurseries list a few of the hardy chrysanthemums in their catalogues, but these varieties are not the ones to be grown in pots. Small potted plants may be obtained in the spring from Elmer D. Smith, of Adrian, Michigan, who grows nothing but chrysanthemums, and C. H. Totty, Madison, N. J. The prices range from fifteen cents to a dollar a plant, and the majority of varieties suitable for the amateur will cost from fifteen to thirty cents a piece. These small plants, which are obtained some time during April and May, are

grown on during the summer in the same way as if they had been propagated by the amateur. After they have bloomed the roots are saved and are carried through the winter in a cold-frame, and these will furnish a number of cuttings the following spring. Two or three stock plants of a variety will furnish more cuttings than are needed by most amateurs, and only occasionally one finds a variety that is a little slow to produce good cutting material. Sometimes these newly-purchased chrysanthemums do not produce as good plants the first year as might be expected, but after they have become acclimated the results will be more successful.

When the flowers have been blackened by a killing frost, Mr. Herr cuts the stalks off just a little above the soil and plunges the pots in the small cold-frames. Plate 36 shows one of these cold-frames which has a glass top and also a glass front. It is constructed in such a manner that the plants require a minimum amount of attention during the cold winter months. At the rear of the frame are four holes two inches in diameter, and at the side is a fifth hole. These holes are closed with corks when the weather is very cold and there is danger of the plants freezing, but during mild spells some of the corks are removed, thereby creating a circulation of air without lifting the sash. A chrysanthemum stock plant can stand a low temperature, just so it does not freeze. If the stock plants are thoroughly watered when plunged in the frames for the winter, they will need no more water until the frame is opened in late March. When severe weather is threatened and the thermometer drops below zero, the frames should be covered with boards, old carpets, or regular cold-frame mats.

Aphis or plant lice will infest the plants during the winter when the frame is closed. Since a small frame 3 x 6 feet is rather difficult to fumigate with some tobacco preparation, Mr. Herr had devised a very unique way of controlling aphis while he is enjoying his favorite pipe. He removes the cork at the side of the frame; through this opening he puffs the smoke from the pipe into the frame by means of a rubber tube, and when the frame is filled with a cloud of smoke he again inserts the cork in the opening. This simple and ingenious way of injecting nicotine fumes into the frame will

control the plant lice which are about the only insects that attack the chrysanthemums. Thrips are not so prevalent on plants that are always kept outdoors, and if they should be present would also be held in check by the nicotine fumes. During the active growing season an occasional spraying of the plants with a nicotine preparation will prevent the appearance of aphis and thrips.

In late March or early April Mr. Herr takes these stock plants from the frames, removes the suckers, trims them, and inserts them in shallow pans of sand. No provision for drainage is made in these pans, only two or three small holes being provided at the side to carry away any surface moisture. Several cuttings of the same variety are inserted in each pan, then they are thoroughly watered, the pans stood on the shelf at the back of the frame and left there until rooted (pl. 36). They seldom have to be watered again before roots have formed. After the cuttings are rooted they are potted into 2½-inch pots and these pots are plunged in the frames. As the weather grows warmer the sash is left up so that the chrysanthemums will grow sturdier with an abundance of fresh air and light. Before the roots become crowded in the small pots the plants are shifted into 4-inch pots and later into 6-inch and 8-inch pots and even larger if necessary. When the weather is settled the plants are plunged in the soil outside along a south fence. Here they are left until the weather becomes cool, about September 15. From then on the plants are grown in a sheltered place where they can be protected at the top and sides when light frosts threaten. When the flowers begin expanding the plants are moved to the east veranda where they are left to bloom.

After severe cold weather has ruined the flowers the plants are again placed in the sheltered frames and the cycle for another chrysanthemum year has started. Chrysanthemums that are grown in this manner need constant attention if success is to be assured. They must be watered daily during the summer and sometimes twice a day in very hot windy weather. The compost for potting the plants is prepared in advance and consists of loam, decayed leaves, and old cow manure. Mr. Herr does not feed his plants until the buds develop. Premature feeding will cause some plants to come blind (no

CHRYSANTHEMUM CUTTINGS IN COLD-FRAME.

CHRYSANTHEMUMS GROWN BY MR. HERR, OF BELLEVILLE, ILLINOIS.

flowers). When the buds are developing an application of liquid manure about every ten days will greatly improve the flowers.

Mr. Herr grows fourteen varieties of chrysanthemums, and plate 37 shows a collection of large-flowering varieties and single, double, and anemone bush varieties as they were displayed in front of his home.

EARLY LARGE-FLOWERING CHRYSANTHEMUMS

Chrysalora—yellow
Gold Lode—golden yellow
Honeydew—canary yellow
Marigold—golden yellow
Miss Arnola Wright—rose pink
Mrs. David Lloyd George—crimson with golden reverse
Mrs. G. G. Mason—blood red with golden reverse
Mrs. Louis B. Tim—earliest and largest white
Quaker Maid — white, but smaller than Mrs. Tim.

EARLY BUSH CHRYSANTHEMUMS

Adironda—golden bronze pompon
Bronze Buckingham — single bronze
Cora Peck Buhl—deep yellow pompon
Dotson—old rose pompon
Fire Bird—red pompon
Irene—white pompon
Leilah—rose pink pompon
Margot—white pompon
Ouray—mahogany brown pompon
Mrs. H. J. Ballagh—cattleya pink anemone
Pink Benten—single pink
Zora—pale yellow pompon

The following varieties, known as the Caprice family, are all early-flowering and produce a wonderful display of flowers. They are very easy to grow and have good foliage, and while the flowers are all of the same shape, there is a great variation in color. The flowers average about two and one-half inches in diameter if grown without disbudding. If only one flower is permitted to develop at the end of each branch, the flowers will be considerably larger.

Angelo—light pink
Butler's Caprice—deep pink
Kathleen Thompson — crimson and yellow
Lilac Caprice—deep lilac
Mrs. Greening—pale lilac
Purple Caprice—purple
White Caprice—white
Yellow Caprice—yellow

THE ASH-TREE BORER AND ITS CONTROL

A careful examination of all ash trees every week in early spring will prevent the disagreeable shock of finding later in the summer that ash-tree borers are well established. Occasionally one comes upon a pile of sawdust (a quart or more) at the base of a tree, and because of its quantity is certain that it could not have escaped attention since the preceding fall when the borers began feeding. Usually, however, rains wash the trunks clean, and most of the "frass" from around the tree disappears, thus making a very thorough weekly examination necessary.

Small tufts of sawdust hanging to the bark give the first indication of the presence of ash-tree borers. Beneath this "frass" a small hole will be found, and as the borer grows larger both the size of hole and the amount of "frass" will increase. In late summer the borer may be one and a half inches long and nearly as thick as a lead pencil. The damage done by a dozen full-grown larvae is startling; sawing through the tree would not yield as much sawdust. The eggs are laid on the bark in August and September by a wasp-like insect *(Podosesia fraxini)* having bright yellow legs, brown body and wings. Upon hatching the larvae bore through the bark and eat a section, sometimes amounting to two or three square inches, of the soft inner bark. Then they begin to bore inward, either upward or downward, to emerge as a full-grown adult late in summer of the following year. The greatest damage is done to the sapwood and heartwood, weakening the tree and allowing other insects and fungi to enter. Fortunately there is but one generation a year.

Last spring the ash trees in the Garden were seriously attacked, and various methods were resorted to to save the trees from total destruction. Formerly the forcing of a soft wire into the gallery or the injection of carbon bisulphide was advocated. These methods proved effective when there were but few borers in occasional trees, but were of little value last spring when so many trees had to be treated. Of the various materials tried carbon tetrachloride proved most satisfactory. It is a non-inflammable, odorless, and colorless liquid often used by cleaners, and may be purchased at most

CUTTING AWAY DYING BARK OF INFESTED TREE.

INJECTING CARBON TETRACHLORIDE.

BORER BACKING OUT OF GALLERY.

CAST PUPAL SKIN OF BORER.

drug stores. It is an improvement over carbon bisulphide and similar liquids which are usually smelly, irritating, and somewhat dangerous to handle.

An ash tree with some new galleries and a pile of sawdust, together with the dead bark and exposed sapwood of older infestations is shown in pl. 33. The first step in control is cutting away the dying bark to expose the gallery (pl. 38, fig. 1), then the injection of carbon tetrachloride with a long bent-spout oil-can as shown in pl. 38, fig. 2. The galleries may then be sealed with putty, but this seems to have little practical value since carbon tetrachloride is not an efficient fumigant under these conditions. The chemical does its work by coming in contact with the borer, when death is almost instantaneous. Occasionally a full-grown larva will back out of his gallery (pl. 39, fig. 1) after carbon tetrachloride is injected, allowing a close examination of the powerful jaws that can be so destructive to our trees. If no new "frass" is pushed to the gallery entrance after a few days one may be certain that the borer is dead. If more sawdust appears another injection is necessary. Two trees which were examined contained over three hundred entrance holes. After injecting carbon tetrachloride a careful watch was kept and only twenty-seven borers emerged. Upon investigation it was found that these borers moved upward, a few emerging twelve inches above their entrance. In pl. 39, fig. 2, the pupal skin from which an adult emerged is shown protruding from the gallery.

As has been stated, carbon tetrachloride is a contacticide and kills only when touching the borer. For this reason the most careful work sometimes seems wasted, especially when the galleries slope upward and the liquid cannot flow into them. Other materials and methods are being tried at the Garden in an effort to simplify the methol of control and to find a poison which will prove more effective regardless of the slope of the galleries. These experiments will be reported in a later bulletin.

Not all borers are as easily controlled as the ash-tree borer; some spend their lives in galleries the shape or direction of which permits little opportunity for treatment. The locust-tree borer is one of these. Nearly all black locust trees are

injured by a beetle the larvae of which bore into the heartwood. Holes one-quarter inch or more in diameter on any part of the trunk or larger limbs are an indication of the presence of this pest. Discolored sap and sawdust will partly hide the holes. Control is much more difficult, since because of the looping galleries the borer cannot be reached by carbon tetrachloride. Removal of a single limb or the whole tree is usually necessary. Three other borers, "flat-head," "round-head," and "pigeon tremex," frequently injure trees, particularly those in poor condition. Feeding and better care of trees will do much to lessen the damage. The poplar borers and willow borers excavate galleries similar to those of the ash-tree borer, but much longer. Carbon tetrachloride carefully injected will kill a few, and a soft wire forced into the galleries will help. A healthy tree is after all the best weapon with which to fight an attack of borers, since no single method thus far devised for eradicating these last-named borers is entirely successful.

NOTES

Dr. Hermann von Schrenk, Pathologist to the Garden, delivered an address to the engineering departments of the University of Illinois, Urbana, November 21, on "Timber and Timber Preservation."

Dr. Henry Schmitz, Dean of the School of Forestry, University of Minnesota, formerly a Rufus J. Lackland Fellow in the Henry Shaw School of Botany, visited the Garden, December 13.

Dr. Edgar Anderson, Geneticist to the Garden, who is spending a year at the John Innes Horticultural Institute, at Merton, England, spoke before the Genetical Society, November 29, in the rooms of the Linnean Society, London, on "Variation in Two Species of Iris."

Mr. George H. Pring, Superintendent of the Garden, gave an illustrated lecture before the Garden Club of Gray Summit, December 2, on "Collecting Orchids in the Andes of Colombia"; and on December 10 he spoke before the Parent-Teacher Association of the Stix School on "The Missouri Botanical Garden Floral Exhibitions."

A notice of the death, on December 19, of Baron Ferdinand

von Miller, of Munich, Germany, has been received. He was 87 years of age. Baron von Miller was the sculptor of the portrait statue of Henry Shaw which lies on his sarcophagus in the mausoleum at the Garden. He was also the sculptor of the statues of Humboldt, Shakespeare, and Columbus, given by Henry Shaw to Tower Grove Park. The Garden Bulletins for September and November, 1918, contain extracts from letters of Baron von Miller to Henry Shaw, which throw an interesting light on the origin of the various statues.

A conference was called, December 12 and 13, by Dr. Hermann von Schrenk, Pathologist to the Garden, of the pathologists interested in making cultures of wood-destroying fungi, for the purpose of testing the toxicity of substances used for the preservation of wood. Following a very general discussion as to the methods now in use, a standard method entitled "A Toximetric Method for Growing Wood-destroying Fungi" was worked out and unanimously adopted. A list of wood-destroying fungi to be used for standard tests was also adopted.

The conference spent most of the second day discussing conclusions which could be drawn from results obtained by making standard culture tests. It was decided to organize as a permanent body, with Dr. von Schrenk as chairman, and Dr. Henry Schmitz as secretary. The outline for further work and general supervision of the same was intrusted to a committee consisting of Dr. Schmitz, chairman, Dr. C. Audrey Richards, and Mr. R. E. Waterman.

Those present at the conference were: Dr. Henry Schmitz, of the University of Minnesota, Mr. J. D. Burnes, of Page and Hill, Mr. Ernest Bateman, Senior Chemist, U. S. Forest Products Laboratory, Dr. Carl Hartley, Principal Pathologist, and Dr. C. Audrey Richards, Pathologist, Bureau of Plant Industry, United States Department of Agriculture, Dr. R. H. Colley and Mr. R. E. Waterman, of the Bell Telephone Laboratories, Mr. C. S. Reeve of the Barrett Co., Mr. S. R. Church, Consulting Engineer, Mr. E. B. Fulks, Vice-President, American Creosoting Co., Dr. A. L. Kammerer, Consulting Timber Engineer, St. Louis, Dr. David H. Linder, Mycologist, and Dr. Hermann von Schrenk, Pathologist, Missouri Botanical Garden, St. Louis.

STATISTICAL INFORMATION FOR NOVEMBER, 1929

GARDEN ATTENDANCE:

Total number of visitors	78,865

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	116
Total number of books and pamphlets donated	97

PLANT ACCESSIONS:

Total number of plants donated	16
Total number of packets of seed donated	64

PLANT DISTRIBUTION:

Total number of plants distributed as gifts	205

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FLORAL DISPLAYS OF SPECIAL INTEREST IN 1929

In order that readers of the BULLETIN may have a more comprehensive idea of the various flower shows and outdoor exhibits which from month to month may be seen at the Garden, the following tentative schedule is given. While the indoor exhibits can be quite definitely indicated, the blooming period of outdoor plants is subject to variation, depending upon the weather, and out-of-town readers should confirm the date of any display before visiting the Garden.

APRIL
(Floral Display House)
Azaleas. Native flowers from Gray Summit Extension.
(Outdoors)
Pansies, English daisies, Early-flowering shrubs.

MAY
(Floral Display House)
Hybrid Pelargoniums, Salpiglossis, Begonias. Special Iris Display.
(Outdoors)
Bulbs (early in month), Hardy water-lilies, Peonies.
Iris (late in month), Spring-flowering shrubs and perennials.

JUNE
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Roses, Hollyhocks. Medicinal Garden.

JULY
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical plants. Annuals. Economic Garden, farm crops, fiber plants, rice, cotton, peanuts, tobacco, sugar-cane. Medicinal Garden.

AUGUST
(Floral Display House)
What goes on at the Missouri Botanical Garden; a bird's-eye view of its various activities.
(Outdoors)
Tropical water-lilies, Victoria Cruziana, Lotus lilies. Economic Garden. Medicinal Garden.

SEPTEMBER
(Outdoors)
Tropical water-lilies. Economic Garden. Medicinal Garden.

OCTOBER
(Floral Display House)
Dahlia Show (novelties and newer varieties).

NOVEMBER
(Floral Display House)
Chrysanthemum Show.

DECEMBER
(Floral Display House)
Poinsettias, Stevias.

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises about 75 acres. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden. About 12,000 species of plants are growing in the Garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove avenue and Flora place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

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